OULUN YLIOPISTO
UNIVERSITY of OULU

OULUN YLIOPISTON KAUPPAKORKEAKOULU

Henri Fröjdholm

INDEX PREMIUM IN NORDIC STOCK MARKETS

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Unit			
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Author		Supervisor	
Fröjdholm, Henri		Prof. Juha-Pekka Kallunki	
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Abstract

This thesis examines the index premium phenomenon in Nordic stock markets during 2008-2020 using two event dates for each inclusion and exclusion in a sample of 819 events in total from 18 indices focused on Nordic stock markets. In addition to classic short term event study, this thesis extends it with long term windows following Lynch and Mendenhall (1997) in order to capture long term behaviour of abnormal prices with regards to the two event dates for each inclusion and exclusion.

The empirical results show abnormal price action around small cap and the entire region spanning index composition change announcements for affected stocks as well as the abnormal price action of affected stocks as the composition change is which they are excluded is implemented. The reaction to exclusion is larger in magnitude and behaves differently to that of inclusions. For changes in country specific blue chip indices no abnormal price action is detected.

Although minor index premium as found in this thesis is expected based on the previous theoretical and empirical literature, the behaviour of the premium found here is contradictory to previous literature.

Keywords
Index premium, event study
Additional information

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1 INTRODUCTION

1.1 Motivation

In finance, a taxi driver talking about his investments is often used as an analogy to a situation when irrational exuberance is at its peak and the 'top is in.' However, when it comes to passive investing or *long-term investment in cost-effective index funds* it is not only the layman but also the finance professionals repeating the mantra. In my experience, it is not uncommon for some people to even think that at some time somewhere monkeys have *actually* been given darts in order to find out whether by throwing them they could pick stocks better than professional money managers.

Passive investing in ETF's and index-tracking funds has seen major growth during the current decade. In fact, according to Morningstar, the number of US-based index funds and ETF's surpassed the number of US-based actively managed investment funds in August of 2019. According to JP Morgan, 60% of US equities are controlled by passive investments such as index funds and ETF's.

Because unquestioned truths are the ones in need of questioning this thesis takes a look at market efficiency and the conclusion about it in favour of passive investment from the point of view of a side effect they cause: the index premium.

Index premium refers to a price premium a stock gains (loses) when entering (exiting) an index. Based on research and intuition, index premium is caused by excess demand from index tracking investors for stocks that are included in indices they follow, although some theories based on informational benefits and signals of index inclusion are supported. As index composition changes are easily forecasted for most indices, forecastable excess demand from indexers could create opportunities for arbitrage that indexers would pay for via index turnover cost caused by stock prices being inflated with index premium when entering the index and deflated when exiting.

Although index premium as a research subject has been somewhat forgotten during the 2010s the ever-increasing popularity of passive investing as an investing style makes it worthwhile to examine whether passive investing has had an impact on index premium, and whether the index premium has an impact on passive investing returns.

Nordics are an interesting region for studying index premium for various reasons. Nordic countries are small developed countries in northern Europe with close geographical, historical, and cultural ties. As small economies with small capital markets Nordic stock markets assumedly appear to foreign investors as similar to ones of some emerging markets with small and obscure companies with little analyst coverage. Being this kind of developed emerging market underlines the possible informational benefits of index inclusion as foreign capital is less likely to analyze Nordic non-index stocks as a potential investment or at all.

1.2 Earlier Studies

The efficient market hypothesis, first formulated by Fama (1970) expanding on the work of Kendal (1953) Sharpe (1964) and Litner (1965), is such a cornerstone theory in finance that even when it and its predecessors dominated academic literature for near 20 years *only,* the debate goes on to this date. Jensen's (1978) practically and theoretically appealing formulation of efficient market hypothesis states that if for some reason markets presented an opportunity for earning risk-adjusted excess returns, arbitrageurs would exploit it until it diminishes to an extent at which risk-adjusted excess returns can no longer be achieved.

Another view on the same issue lies around a theoretical concept of market portfolio *m* as in Sharpe (1964) and Litner (1965). According to Malkiel (2003b), each time an investor buys or sells an asset the counterparty of that trade is an investor who sells or buys that asset. Therefore, in aggregate any profitable trade is offset by an equally unprofitable trade and while the return of the market portfolio m is the expected return for both, both lose the transaction costs of their trades.

Combining these views leads to a conclusion that when an investor thinks he has found an untapped arbitrage opportunity he is just as likely to be wrong and thus rational conclusion is to abstain from active trading as it is only expected to yield the costs it causes. As a result, an entire industry of passive investment products has risen to exploit this conclusion.

However, as any market, neither the stock market consists of homogenous and rational investors and none can see into future. In the 1980's Schiller (1980) and Schiller and Campbell (1988) pioneered a branch of finance literature in favour of possibility of long term forecastability in stock returns. Regardless the misconception that stock returns are unpredictable in all timeframes and the empirical evidence about active managers generally underperforming their benchmark indices after costs have led to popularity of passive investing style both in academia and in practice which relies on replicating the performance of indices while minimizing management related costs. Indices are essentially diversified portfolios of assets that represent the performance of a market or a segment of a market. As the pioneering work of Markowitz (1952) shows, diversification of assets is an integral part of rational portfolio management. Later work regarding diversification shows that the optimal number of securities in a well diversified portfolio is nowadays close to 300 (Statman, 2004) and achieving such portfolio practically requires utilization of index tracking mutual funds or ETFs.

Shleifer (1986) and Harris and Gurel (1986) pioneered the literature on the effects of index tracking capital on stock prices. Shleifer (1986) assumes that stocks have a long-term downward sloping demand curves due to individual stocks not having close substitutes in terms of company and performance characteristics (imperfect substitutes hypothesis) and finds supporting evidence in form of persistent price impacts during S&P 500 composition changes caused by non-fundamental demand shocks from indexers. Harris and Gurel (1986) present price pressure hypothesis that assume only short-term downward sloping demand curves for which they find supporting evidence in form of price shocks to S&P 500 composition changes that reverse quickly.

Multiple theories for the index premium explain it by the information the index membership carries. According to Jain (1987), inclusion in an index is a sign that the company is managed well and expected to perform well in the future (information hypothesis). He finds that even in events where stocks are included in indices that are not tracked by passive investors stocks have a positive price response. Chung, McInish, Wood & Wyhowski (1995) argue that stocks included in indices are followed by more analysts and as a result the market has less asymmetric information about them decreasing spreads and increasing liquidity justifying higher price (liquidity hypothesis). Denis, McConnel, Ovtchinnikov, and Yu (2003) argue that index premium might be a result of investors being unaware of the existence of stocks that are not included in indices and of Merton's (1987) shadow cost (investor awareness hypothesis) Chen, Noronha, and Singal (2004) also find supporting evidence for investor awareness hypothesis in form of positive price increase caused by index inclusions and lack of similar negative price effect for exclusions which they conclude to support the idea that investors do not forget the companies when they are excluded from indices.

According to Wurgler and Zhuravskaya (2002) index premium is at least partly due to idiosyncratic risk in stocks during index composition changes. Petajisto (2011) arrives at a similar conclusion but argues that arbitrage risk does not entirely explain the index premium he finds in the S&P 500 and in Russell 2000.

Petajisto (2011) formalizes 'index turnover cost' based on the notion that some earlier studies such as Lynch and Mendenhall (1997) have made: If stocks enter the index at price inflated by the index premium and exit them after the premium has reversed, the index's return decreases as a function of its turnover and the size of the premium.

Morck and Yang (2001) find that the index premium phenomenon has increased along with the increasing popularity of passive investing during the latter half of the 20th century. Using newer data Petajisto (2011) however finds that since 2000 the magnitude of index premium decreased until 2005 which remains the most current well cited empirical research paper on this topic.

Most studies have focused on the the S&P 500 index which is the main blue chip index in US stock markets. However, the S&P 500 is constructed by using a undisclosed methodology and as such is a somewhat exceptional index. The S&P

500 announcements are difficult to forecast while most other indices use transparent construction rules and are easily forecastable and thus front-runnable.

1.3 Research Problem and Methodology

This thesis re-examines the index premium phenomenon by using current data from 2008-2020 and focuses on previously disregarded or unnoticed Nordic stock markets. The goal of the thesis is to find whether Nordic stock markets exhibit the index premium phenomenon and how it behaves. The research question is intentionally left open ended so that it will not impose limits on obtaining a general view about the phenomenon.

Like most early studies about index premium this thesis uses a classic event study methodology. While it is not the most contemporary methodology for studying effects or multiple events, it is an appropriate methodology to use in a revisit of the index premium studying branch of literature that has become less active in the past decade. Following Lynch and Mendenhall (1997) this thesis extends simple short-term event study with a long-term window analysis that enables observing the premium between and after different event windows to distinguish between behaviours suggested by different theories. For clarity, this thesis studies indices that are specific to Nordic stock markets.

The rest of the thesis is structured as follows: Chapter two collects and comments on the general finance literature that has led to the emergence and popularity of the passive investing style. Chapter three focuses on passive investing and index premium by briefly explaining indices and index funds and builds the theoretical framework around the index premium specifically. Chapter four presents the data and methodology used in the empirical section of this thesis and chapter five presents the results. Chapter six concludes the thesis.

2 MARKET EFFICIENCY AND INVESTING

2.1 Random Walk Theory and The Efficient Market Hypothesis

Random walk theory assumes that new information is efficiently priced into asset prices and that asset prices only convey information about past events. Thus, as news cannot be forecasted, the previous variation in asset prices cannot be used to predict future movements (Malkiel, 2003a).

Building upon the random walk theory by Kendall (1953), the efficient market hypothesis (EMH), first presented by Fama (1970), is of the cornerstone theories in modern finance. EMH states that as a pricing mechanism financial markets are efficient in reflecting all available information into asset prices correctly and thus neither technical or fundamental analysis can yield benefit for the individual investor. It is always reasonable to assume that all significant mispricing is already cleared by arbitrageurs and that prices are ‘correct’. The main conclusion from EMH is that rational investors shouldn’t spend resources for information and transactions to gain excess returns.

The market efficiency is traditionally divided into three cases based on what information is reflected into asset prices. *Weak form* market efficiency stands for the case in which historical prices are reflected in asset prices. In *semi-strong form,* other public information such as on earnings announcements and stock splits are included. Finally, *strong form* considers that all relevant information, public or private, is reflected in asset prices (Fama, 1970). As an update to his original paper about efficient market hypothesis Fama (1991) modifies the division of different forms of market efficiency. The weak form now includes also general tests for return predictability, such as interest rates and dividend yields as well as cross-sectional return predictability. That is, the updated *version* of weakly efficient markets fully incorporates any predictive information that has already been disclosed to the public such as predictors derived from income statements, balance sheets, or general performance of assets. The names of semi-strong form and strong form efficiency are changed to *event studies* and *tests for private information*, but the content remains the same: event studies considers cases or *events* where relevant information is disclosed and tests for private information considers whether private information affects asset prices. So far, these proposals have not in large scale replaced the framework of Fama (1970) in finance literature.

The EMH assumes that transaction costs are non-existent, all relevant information is available and free for all market participants, and that all market participants share the views about information's supposed effect on asset prices. While these conditions cannot be met in strict sense, Fama (1970) states that reasonable deviations from them has only a limited effect on market efficiency.

Jensen (1978) formulates market efficiency as such that the prices reflect available information only to the extent at which marginal benefits of acting on other information do not exceed the marginal costs of doing so. This less strict formulation is economically more sensible than the original from 1970 (Fama, 1991). Malkiel (2003a) defines efficiency in a way that "…such markets do not allow investors to earn above-average returns without accepting above-average risks." He continues that markets can be efficient even if they sometimes make mistakes, if many participants are irrational, or if volatility seems irrationally high as long as "true value will win in the end."

Fama (1970) underlines that the EMH poses a joint-hypothesis problem in which market efficiency must be tested against some asset-pricing model and thus the results are always subject to the quality of the pricing model. In fact, the capital asset pricing model (CAPM) on which the original Fama (1970) efficient market hypothesis was based on has proven to be a rather inaccurate model for pricing assets. Fama (1998) examines some notable works of 'event study literature' and using finds that while under and overreactions as well as continuation and reversal of abnormal returns generally appear just as common, they tend to disappear when methodology on determining abnormal returns is adjusted reasonably.

2.2 Forecasting and Market Efficiency

Forecasting asset prices or returns are perhaps the most interesting topic in finance for practitioners and for most academics. Among the latter, there are varying views about whether forecasting is at all possible. According to widely accepted EMH it shouldn't be but there is an extensive body of literature that claims otherwise and an entire school of behavioural finance that is based on the assumption that investors are not rational which is often, incorrectly, assumed to be a condition for EMH. There are two parts to this question: 1) Does EMH allow forecasting returns and 2) to what extent the market is at all efficient?

2.2.1 Short- and Long-Term Forecasting

In the 1970's EMH dominated academia with little opposition (Fama, 1998). At that time a large body of empirical research had concluded that short term returns are impossible to forecast by finding that short term autocorrelation in stock returns is very close to zero and thus had 'confirmed' random walk theory and supported the EMH.

The 1980's saw and increase in academic papers claiming that while short term returns have consistently been shown to be impossible to forecast, long term stock returns could be forecasted for example with financial multiples such as dividend yield ratio (Shiller, 1980) or valuation metrics such as price to earnings (P/E) (Campbell and Shiller, 1988). Fama (1990) finds that proxies for expected return and expected return shocks explain 30% of NYSE value-weighted returns.

According to Shiller (1980) prices deviate from their 'correct' prices given by asset pricing models by a factor of ~30. And converge to their 'real' value in the long term. Fama and French (1988) make similar findings by studying long term autocorrelations in stock prices and finding that aggregate dividend yields predict stock returns and that slowly decaying predictive component in price gains predictive power with a longer time frame. They conclude that this violates EMH or is due to variance in discount rates.

According to Malkiel (2003a) dividend yields are closely related to interest rates and thus dividend yield's forecasting power may be due to the stock market adjusting to economic conditions. In defence of forecastability Cochrane (2008) turns the question around and states that observed variation in dividend yields must mean that either returns are forecastable from dividend yields or dividend growth must be forecastable from stocks prices and shows that there is no empirical support for the latter statement.

According to Timmermann and Granger (2004) EMH doesn't rule out all forms of predictability but only those that provide arbitrage opportunities. They show that time-varying risk-premia can be a source of forecastability and that forecasting models that predict conditional covariance of returns with stochastic discount factor do not violate EMH. Cochrane (2011) also shows that the price dividend ratio corresponds to discount rate variability and that discount rate variability is a crucial topic for asset pricing research.

Hansen (1982) introduced Generalized Method of Moments (GMM) and by rejecting previously untestable consumption capital asset pricing model (CCAPM) that had been offered as a theoretical explanation for discount rate variability Hansen confirmed Shiller's (1980) finding that stock prices deviate too much from values rational asset pricing models suggest even when time varying discount rate is considered. Timmermann and Granger (2004) continue that most economic models such as the CCAPM do not create enough variation in economic risk-premia.

So far it seems that some forms on long term predictability have both empirical and theoretical support contrary to common misconception that forecasting is categorically impossible. The conclusion drawn from not finding short term autocorrelation in the ' '60s may have been overstated.

2.2.2 Persistence of Forecastability

EMH does not allow persistent arbitrage opportunities. According to EMH mispricings and phenomena providing opportunities for arbitrage should disappear due to arbitrageurs exploiting them to the extent that they lose economic significance. Therefore, one would expect that such mispricings and phenomena are only temporary as eventually, enough traders discover them by themselves or by them being published. Persistent phenomena violate EMH or are subject to some factor that the asset pricing model being used to evaluate excess returns does not capture. Timmermann and Granger (2004) argue that it takes some time for market to learn new forecasting methods and thus the decay of forecasting power is slower than strict EMH would suggest.

McLeod and Pontiff (2016) study 97 cross-sectional predictors of stock returns published in peer-reviewed academic journals and find an average of 32% decline in predicting power since publication. Since the decline signals that the predictability was in part due to mispricing arbitrageurs seem to utilize and crowd out such opportunities as suggested by EMH. Malkiel (2003a) also states that forecasting methods tend to lose power after they are published.

2.2.3 Misconceptions About Forecastability and Efficiency

In 2013 Eugene Fama, Lars Peter Hansen and Robert Shiller got a shared Nobel prize in economics for their work on different sides on asset pricing. Shiller and Fama are often considered to be in a grave disagreement regarding market efficiency and dividing the prize among them and Hansen who's work allows bridging the gap between Shiller's and Fama's work and interpretations underlines how forecasting and market efficiency can actually work together.

The EMH is based on the idea that informed market participants are financially incentivized to clear mispricings. Economically realistic interpretations of market efficiency such as Malkiel (2003a) do not deny occasional divergence from perfect efficiency equilibria but instead require occasional forecastability and arbitrage to bring prices to their 'correct' levels. However, as markets tend to be generally efficient, without other information, it is always reasonable to assume that any price is 'correct'.

It is not necessary for all or even most of the investors to be rational and informed for prices to converge to their 'correct' levels and this is most certainly not the case in reality either. One might argue that given similar objectives as all trades have two opposite sides one must ‘lose’ and other must ‘win’. Realistically a rational investor cannot be certain whether he is the one who is right or the one who only thinks he’s right and uncertainty about future events further adds element of luck into the trade. Thus, it is impossible to know *ex post* whether the result was by chance. Strict proponents of EMH can always argue that even consistently successful traders and fund managers are only very lucky outliers and that their performance in unlikely to persist.

A typical conclusion about market efficiency is thus that investors should always invest in passive strategies and minimize costs related to investing as they would be wasted. Although this view is increasingly adopted in investment community, especially among retail investors, it is an oversimplification that does not consider relevant issues such as risk aversion and investment horizon.

While the conclusion that EMH denies all forms of return predictability on all time frames is incorrect it and an assumption that such EMH is an accurate description of reality has led to a great popularity of passive investment strategies, the answer to the question whether forecasting returns can be used to reliably earn higher returns in long run is not so obvious.

2.3 Modern Portfolio Theory and Diversification

Modern portfolio theory states that investors earn optimal risk adjusted returns by diversifying their investment into a portfolio that has the lowest possible covariance for given expected return. Diversification negates stock specific unsystematic risks and in aggregate only has systematic risk. Because unsystematic risk can be removed without cost it doesn’t account to risk premium and thus brings no reward for investor bearing it. Such efficient portfolios form an efficient frontier with regards to expected returns and portfolio covariance. A rational investor should allocate their investment between the efficient portfolio that has the highest expected return with regards to variance and a risk-free return yielding asset based on their risk tolerance (Markowitz 1952, Sharpe 1964).

Efficient frontiers and portfolios as in Markowitz (1952) as well as market portfolio m (Sharpe, 1964; Litner, 1965) are theoretical concepts and as such inapplicable in investing. In classical Markowitz model portfolios of real assets are optimized based on their mean returns and variances in a way that gives higher weight for assets with high mean return relative to its variance. While the mean-variance-optimization is theoretically attractive, its' usefulness in practice has been contested. According to Michaud (1989) the mean-variance-optimization overweighs and underweights assets of which's metrics are more likely to be a result of an estimation error. DeMiguel, Garlappi, and Uppal (2007) compare the mean-variance model with 14 different methods for correcting estimation errors and find that none yield better results than naïve equally weighted portfolio.

Typical industry assumption has been that most of the benefits from diversification can be achieved with roughly 20 stocks but according to Statman (2004) the optimal number of stocks implied by the mean-variance model has risen closer to 300. Managing such portfolio is obviously unreasonable for most investors and thus optimal diversification in practice requires investing in some sort of funds.

2.4 Passive and Active Investing

2.4.1 Passive Investing

Passive investing is an investment strategy that aims to minimize costs related to transactions and information by holding assets for long periods of time disregarding their short-term price fluctuations. Passive investing aims to capture appreciation across asset classes and markets without spending resources on analysis. Thus, diversification is an integral part of passive investing strategies and large exposure to individual assets is not used to exploit possible mispricing even in the long term.

Index investing (or *indexing*) is probably the most common way to utilize a passive investment strategy. Index investing refers to replicating a performance of an index or indices over the investment period, usually by holding passive funds such as ETFs.

Passive investing and indexing have been shown to outperform active investing after costs by numerous studies. According to Malkiel (2003b) this is due to active investing being a zero-sum game where positive excess returns of one investor are offset by negative excess returns of another. Thus, on average the expected return from active investing is the ‘market return’ minus costs related to transactions and information while passive investing earns just the market return.

Simple passive investing strategies yield profit only when the entire market or the segment of the market tracked by the index rises. While on a very long time this is both expected and observed, lengthy bear markets can significantly impact passive investments performance even on long time frames. The rise of passive investment as an investment style and as an industry since the 1970’s has coincided with the U.S. being in a constant uptrend except for roughly a decade following the dotcom bubble. Even though the simple logic of passive investments outperformance holds in bear markets as well, most of the empirical evidence in favour of passive investing is from a period which arguably has been exceptionally good for this style of investing.

Investors should bear in mind that diversification is the only true free lunch in investing and that passive investing and indexing are simply investing styles among others, although arguably among the best of them. While passive investing typically includes extreme diversification among assets, it bears heavy exposure to market risk or more specific factors captured by the index. Proponents of passive investing tend to argue that stock returns cannot be reliably forecasted. This is true only in the short term and thus passive investing for long term misses out on returns from forecasting.

2.4.2 Active Investing

Active investing is a high-level term for strategies and investment styles where investors aim to exploit profitable conditions by their selection of assets and timing of their purchases based on specific conditions. The main difference between active and passive investing is that active investors try to earn excess return by outsmarting the market.

Typical ways to engage in active investing are investing directly into assets and managing one's portfolio independently or by investing in actively managed funds such as mutual funds or hedge funds. Actively managed funds typically charge higher management fees than passive funds and their performance against passive funds on aggregate does not appear to justify such higher fees.

Active investing allows investors to utilize fluctuations from correct prices and to form strategies that better suit their investing horizons and risk-aversion. Active strategies allow for investors to benefit from various kinds of market conditions and for flexible risk management. Using knowledge and judgement in specific investment decisions may be especially beneficial compared to passive investing in markets and niche industries that are subject to risks related to legislation, civil unrest, or commonality of general untrustworthiness and bad practices in an industry.

2.4.3 Smart Beta

Smart beta refers to investing that aims to gain exposure to specific risk factors rather than to entire market risk or to exploit opportunities in individual assets. Smart beta investments capture risk factors by systematically using predetermined rules to manage assets instead of traditional active management. Management fees for smart beta ETFs typically range between those of active and passive funds.

3 INDICES AND INDEX PREMIUM

3.1 Stock Indices

Stock indices are portfolios of assets constructed to represent the average performance of a market or a segment of a market. Within the finance context many different kinds of indicators (such as CBOE Volatility Index, VIX) are called indices, but here *index* refers strictly to a stock index. Typically, indices have an arbitrary base value which then changes based on the weighted arithmetic mean of returns of stocks in the index. The performance of an index is thus presented by the relative changes in the index's value while the value itself is useless information.

According to Lo (2016) indices have at least two main functions: provide aggregate information about the performance of the economy without focusing on individual assets and serve as a benchmark for active investors. To serve as a benchmark, the index needs to be investable and formed systematically based on public information and rules. Investability requires that the assets included in the index are liquid enough so that an investor is able to replicate the index as an investment portfolio for a short time and during which gain the same return as the index.

The universe of possible assets and the criteria by which the assets are selected depends on the purpose of each individual index. Rather than trying to definitively categorize indices, it is perhaps more sensible to think about them via possible screening criteria. For example, an index could 'invest' globally or screen by region, country, or by their characteristics while at the same time screening by for example company size, industry, or by accounting metrics. The most commonly followed indices are so called 'blue chip' indices that usually include a number of the most traded stocks in a market that makes the index capture reasonably high portion of free-floating stocks within that market without sacrificing liquidity.

There are plenty of ways to determine the weights of stocks in an index with the most common ones being price-weighted (stocks with higher nominal value have higher weight), capitalization-weighted (weights based on the market value of the companies), and equal-weighted (each stock's performance has equal effect regardless of nominal price or market cap), capitalization-weighted being to the most common. Weighing based on capitalization is arguably the most representative for entire markets as stock market in aggregate is capitalization weighted as well. However, as capitalization-weighting emphasizes performance of large stocks which in general tend to have lower returns compared to smaller stocks, capitalization-weighted indices may not work as well as a benchmark for all investing strategies.

Indices are rebalanced and modified from time to time to keep the index representative of the market or a segment of a market. Typically, indices are rebalanced periodically such as annually (e.g. FTSE Russel indices), semi-annually (e.g. FTSE, and OMX indices), or even quarterly (MSCI), but some indices are reviewed at random times based on the judgement of the provider (e.g. S&P 500).

3.2 Index Funds

3.2.1 Indexing

Index funds are mutual funds and ETFs that aim to replicate the performance of some index. Instead of trying to enhance risk-adjusted or absolute returns, the main goal of index fund management is to replicate the chosen index as closely as possible and to reduce their tracking error. Funds may achieve the replication either by physically investing in the underlying assets of an index (physical fund) or by using derivatives contracts, mainly swaps (synthetic funds). Synthetic indexing makes it easier to exactly replicate the performance of indices regardless of their liquidity, but using derivatives results in synthetic indexers bearing a counterparty risk and being subject to stricter regulation, compared to physical indexers. Physical replication can be achieved by owning all stocks in an index (full replication), but as with large indices full replication can be impractical, some funds aim to replicate the index by owning only a portion of stocks included in the index (sampling).

3.2.2 Mutual Funds

Mutual funds are a traditional form of funds where a group of investors essentially pool their capital together to a fund that is managed by professional money manager.

Investors are entitled to the capital in the fund in proportion to fund shares they own. Fund's total net asset value (NAV) and thus the value of each share is calculated at the end of each trading day. Typically, open-ended mutual funds allow investors to buy or redeem shares once a day at a pre-determined cut-off time based on last day's NAV. As each day open-ended mutual funds must transfer cash back and forth between themselves and investors, in order to avoid forced excess trading mutual funds hold a portion of their capital as cash diminishing potential return.

According to Gastineau (2004) index mutual funds tend to outperform ETFs following the same indices due to mutual fund managers being aggressive in efforts to recapture transaction costs related to index revisions. Index mutual funds take advantage of the time between index composition change announcement and effective date by shifting their portfolios toward the structure of the new index before the effective date enhancing their return.

3.2.3 ETFs

ETFs are relatively new investment vehicle, introduced in the 1990s in the U.S. and in the 2000's in Europe. The key difference between traditional mutual funds and shares of ETFs are traded on exchanges like stocks while mutual funds interact with investors typically once a day. To achieve this liquidity ETFs are structured different to mutual funds. ETFs are created and operated by a process of creation and redemption. Each day the fund (sponsor) posts the structure of the portfolio it tries to achieve. Authorized participants, namely some large financial institutions, then buy the securities needed to form a large portfolio with such structure from the open market. Authorized participant exchanges this 'creation unit' with the sponsor for ETF shares worth the same as the securities in the creation unit and sells the shares on open market. If investors bid up the ETF share price relative to the value of the underlying securities, authorized participant can repeat this process of creation by buying more of the securities bidding up their price, exchanging them for a new creation unit of ETF shares, and selling the new ETF shares on open market bringing their price down. Similarly, if the ETF shares trade at a discount to the underlying securities, authorized participant can engage in opposite process called 'redemption'.

Thus, the authorized participants ensure that the ETFs price does not deviate much from the value of its underlying securities by arbitrage.

As the sponsor needs to do very little to manage its portfolio, the management fees of ETFs are typically very low compared to mutual funds. ETFs are also typically treated as stocks in taxation. These qualities have made ETFs as an attractive long-term investments.

3.2.4 Closet Indexing

Closet indexing is a questionable practice in which active managers secretly replicate their benchmark index in order to not fall below it. Varying levels of the active portfolio can be indexed and while combining active and passive management might be appropriate as a general investing strategy, any level of shadow indexing is problematic because as a result the manager charges active fees for passive management without the investor knowing about it. The exact amount of closet indexed capital is unknown, but it is reasonable to assume that at least a small portion of capital reportedly under active management is in fact indexed.

3.2.5 Tracking Error

According to Frino, Gallagher, and Neubert (2004) tracking error consists of endogenous component caused by imperfection in open-end index fund’s replication strategy and of exogenous component caused by changes in the underlying index. Both components are due to index funds being subject to market frictions while the indices they are trying to replicate are essentially mathematical calculations without restrictions imposed by real markets. They find that index revisions are a significant driver of tracking error in passive funds.

3.2.6 Index Revision Replication Strategies

For an ETF the simplest and the most common strategy to adjust its portfolio to a change in the index is to simply post new creation/redemption baskets on the day the index change comes into effect and let the authorized participants announce whether they plan to create or redeem at the end of the trading day, creating uncertainty about whether additional trading is required to match the new index. This procedure leads the fund to replicate the index with an exogenous component in tracking error that matches the fund's expense ratio. While there is evidence that modifying the portfolio and creation/redemption baskets before the official implementation of new index would be beneficial, ETF portfolio managers are reluctant to engage more sophisticated strategies implemented by mutual fund managers due to differences in regulations between the two fund types (Gasteneau, 2004).

Simply updating creation and redemption baskets does not however rebalance the ETF's portfolio. Creation and redemption processes do not 'clear out' the excluded stocks and without the correct amount of included stocks in the portfolio, redemption would not be possible. According to finance expert Martin Paasi (2020) ETF's rebalance their portfolios manually or with the market maker which for example commits on performing the trades with closing prices.

Fundamentally ETFs' cost efficiency stems from the fact that ETFs operate in a way in which other market participants take care of transactions in the market and ETFs engage with authorized participants only by predetermined rules.

3.2.7 Criticism on Indexing

Indexing and passive investing in general raise a lot of criticism and mixed feelings among academics and practitioners. While the motivation for passive investing can be seen as an insult to active investors' trade, passive investing relies on active investors in terms of price discovery and market efficiency. While there is little evidence that passive investing is yet dominant enough to significantly adversely impact price discovery, it has some economic effects that can be expected to increase in magnitude as passive investing continues to become ever more popular.

According to Wurgler (2010), indexing increases correlation in stock prices in the index with among each other and the index price due to fund inflows and outflows affecting included stocks, an effect which he calls 'detachment'. This causes the prices of stocks in index to behave differently to the prices of similar stocks excluded from the index and the stocks in the index to deviate from their 'correct' prices due to being in an index. Further he argues that detachment makes the index less representative of the market which violates what was the motivation for index investing in the first place.

Brown, Davies, and Ringgenberg (2019) find that ETF fund flows distort stock prices due to non-fundamental demand and that shorting high flow ETFs while going long in low flow ETFs earns 1% - 4% monthly excess return. They also find that fund flows lead ETFs to systematically mistime their investments which leads to underperformance. Cha and Lee (2001) find that equity mutual fund flows are driven by market performance and that equity mutual fund flows do not appear to influence market performance.

Morck and Yang (2001) speculate on the possibility of an "indexing bubble" where increasing fund flows enhance the performance of indexing and therefore attract even more fund flows. According to Wurgler (2010) this mechanism makes indexing represent a momentum strategy.

John Bogle (2018), pioneer in index fund industry, warned that increasing popularity of index investing would eventually lead to index fund companies owning over 50% of the U.S. stocks with BlackRock, State Street, and Vanguard together owning over 30%.

3.3 The Index Premium

Index premium is premium in the price of a stock that is included in an index. Although the literature uses varying names for this phenomenon, e.g. 'Index inclusion effect' (or 'S&P500 effect' in studies focusing on said index), the meaning of this phenomenon in simple and uniform in the literature. This study uses the term 'index premium' as it best describes the phenomenon, a price *premium* caused by membership in an *index*. Other than that, the definition is intentionally left vague in order to capture the whole phenomenon and its behaviour.

Historically the theories explaining the index premium were price pressure hypothesis, imperfect substitutes hypothesis and information hypothesis but since price pressure and imperfect substitutes are essentially the same hypothesis about downward sloping demand curves and excess demand, with slightly different assumptions, it is simpler to consider them in a category of demand-based theories. Also, as information hypothesis consists of a plethora of different hypotheses, it should be considered as a category instead of a single hypothesis.

Demand based theories focus on the effect of excess demand and supply caused by passive investors rebalancing their portfolios around index composition changes. They assume a downward sloping demand curve for stocks and differ in terms of rationale for it, resulting in different conclusions about the timeframe at which the demand curves slope down (long-term vs short-term) and thus different assumptions about the duration or persistence of the price premium. Demand based theories assume the index premium to be a mispricing contradicting with semi-strong form of market efficiency.

Information based theories explain the index premium by information and signals the index membership relays about the company. While there is numerous information-based theories, they are similar in that they assume that the market doesn’t utilize public information efficiently and that index inclusion confirms, highlights, or *refines* information for investors. From this point of view price with the premium is the ‘correct’ one while without the premium, it would be at a discount.

In October 1989 Standard & Poor’s began announcing index revisions about week one in advance to the date the change came into effect. Studies using earlier data from the S&P500 are thus more subject to a situation where the information shock and mechanical demand shocks from passive investors happen simultaneously. Lynch and Mendenhall (1997) find that after this date the S&P 500 inclusion announcement is followed by positive abnormal returns and the actual inclusion is followed by negative abnormal returns (vice versa for deletions) while studies using data before this date find significant abnormal returns on the announcement date and vary on their findings about reversals. The now common practice of announcing index composition changes beforehand separates the information event from the mechanical excess demand from passive investors and to some extent allow for testing demand and information-based theories separately.

3.3.1 Demand-based Theories

The price pressure hypothesis, first introduced by Scholes (1972), assumes that stocks have a short term downward sloping demand curve. Due to the downward sloping demand curve an extra supply in a stock due to secondary equity distribution causes a discount or a “sweetener” in the stock price to induce the market participants to buy them. Scholes (1972) examines the price impact of secondary distributions but finds that while stocks have a high price elasticity, the price movement related to such events is caused by the information they include. Mikkelson and Partch (1985) find that the magnitude of price impact caused by secondary offerings is related to the size of the offering, large offering causing large impacts, but also conclude that the effect is due information revealed by the offering. In his pioneering work regarding index premium Shleifer (1986) examined the price impact of S&P 500 revisions to find whether the excess demand from passive investors provided evidence for downward sloping demand curves and concludes that the strong and persistent price effect from index revisions supports the hypothesis of downward sloping demand curves.

Based on the substitution hypothesis which states that demand curves for stocks are flat due to stocks having substitute stocks with similar characteristics (Scholes, 1972) Harris and Gurel (1986) introduce its reversal, the imperfect substitutes hypothesis, and the notion of short term and long term downward sloping demand curves. The imperfect substitutes hypothesis assumes that due to stocks not having close substitutes, the demand curves slope down in the long term and therefore demand shocks cause the demand curve to shift and form a new equilibrium price instead of causing only temporary price shock. Shleifer (1986) results in fact seem to specifically support long-term downward sloping demand curves even though he doesn’t make that distinction.

Using S&P 500 data from 1976 to 1989 Wurgler and Zhuravskaya (2002) find that individual stocks in fact rarely have close substitutes, that the stocks that have close substitutes also have flatter demand curves, and that idiosyncratic risk (arbitrage risk) may explain the downward sloping demand curves. On more recent data from S&P 500 and Russell 2000, Petajisto (2011) also estimates that idiosyncratic risk has an economically significant effect on abnormal price activity around index composition changes. Petajisto (2009) however argues that limits to arbitrage does not fully cover the magnitude of index premium.

In Harris and Gurel (1986) formulation the price pressure hypothesis assumes only a short term downward sloping demand curve, due to suppliers of liquidity requiring a compensation, and perfect price elasticity of demand in the long term and thus violates the EMH only in short term. This translates to demand shocks causing only temporary price shocks and thus the price pressure hypothesis is supported by evidence in which a price reversal is observed and conversely the imperfect substitutes hypothesis is supported when reversal is not observed.

Chakrabarti, Huang, Jayaraman, and Lee (2004) study changes in MSCI country indices significant positive excess returns as well as excess volumes for the periods between inclusion announcement and effective date, supporting downward sloping demand curves. They also find support for liquidity hypothesis and price-pressure hypothesis in Japan and UK.

Biktimirov (2004) studies a mechanical conversion of TIPs 35 and TIPs 100 funds into a new i60 Fund in March 6, 2000 where 40 stocks from TIPs 100 were excluded and finds permanent stock price decline and increased trading volume, supporting downward sloping demand curves. Kaul, Mehrotra and Morck (2000) study the methodology changes based mechanical rebalancing of TSE 300 index in 1996, which was purely information free event, and find price shocks relative to changes in index weighting that do not revert in short term.

Dhillon and Johnson (1991) study index inclusions in options markets and find that call options of included stocks increase on the announcement date signalling that the market assumes the price change in the underlying to persists until the maturity of the contract, supporting long term downward sloping demand curves, but also information-based theories. They also find that the price of corresponding put options doesn't rise, signalling that the options price changes are not solely due to volatility.

As a contrast to most studies which focus on events, Cha and Lee (2001) examine continuous equity mutual fund flows and find no support for price pressure hypothesis or downward sloping demand curves in general.

3.3.2 Information-based Theories

According to Chen, Noronha, and Singal (2004) excess return related to index revisions does not necessarily violate near perfect elasticity of demand curves for stocks if they are due to changes in expected future cash flow or to changes in discount rate for the stock. These are the core of information-based theories for index premium.

Information hypothesis is based on the idea that stock's inclusion to an index is a signal about the firm being industry leader or having competent management (Jain, 1987), or in other words of, of being high quality. Therefore, companies that are included in indices are expected to perform well in the future. Similarly, the exclusion can be seen as a signal that the company has deteriorated relative to its peers and is unlikely to reverse in short term. Because indices typically include a fixed number of companies, they are evaluated relative to each other. Therefore, according to information hypothesis, inclusion signals that the company is of high quality relative to other candidates and thus of high quality in absolute terms as well. While exclusion may be due to degradation in company's fundamentals, it may also be due improvement in other companies' fundamentals. Once company's 'top status' has been confirmed by inclusion in an index that takes fundamentals into account it shouldn't then quickly disappear only due to exclusion and therefore information hypothesis doesn't support full reversal of index premium at exclusion.

According to Kaul, Mehrotra and Morck (2000) as Standard and Poors' states about S&P 500 that "to keep the Index representative and updated, but always within the context of the basic principal [sic] of stability of composition, and every effort is made to avoid excessive turnover." Inclusion in S&P 500 may signal that Standard and Poor's, a rating company, considers included company to be in good financial condition and expects it to remain so. This underlines the point of view that even if index revisions are based on public information, index inclusions may reduce the asymmetry of conclusions about it. According to Chen, et al. (2004) inclusion in S&P 500 may help a company to raise additional capital to grow the company. This should also lead to reduction in cost of capital and thus increase profits.

According to the liquidity hypothesis, stocks inclusion to an index increases its' liquidity and thus its price. The increased liquidity also attracts analysts to process information about the firm which decreases information asymmetry and thus further increases liquidity and price due to decline in spread (Chung, McInish, Wood & Wyhowski, 1995). Wurgler and Zhuravskaya (2002) argue that since passive investors do not engage in trading outside index revisions, index inclusion in fact reduces stock's liquidity. On the other hand, membership in an index may increase trustworthiness and investability of a stock for institutions and foreign investors, therefore increasing the liquidity in the remaining free float.

Following Merton (1987) the investor awareness hypothesis assumes that investors are more likely to be aware of companies included in indices. Increased investor awareness incentivises management to deliver better results. Because investor awareness is unlikely to diminish rapidly when a company is removed from an index, investor awareness hypothesis offers one possible explanation for a large number of empirical studies finding that the negative price effect of index exclusion is smaller in magnitude than the positive price effect from index inclusions and not permanent (Denis, McConnell, Ovtchinnikov, and Yu, 2003). Further, the possible decline in company's fundamentals is more likely noticed faster and priced in if the company is more thoroughly scrutinized by analysts and investors reducing the magnitude of eventual deletion announcement.

3.3.3 Transparency of Index Changes

Rating agencies and other companies maintaining indices use varying methodologies and criteria as a base for their decisions about index composition. While they use varying selection criteria in terms of financial metrics, they also differ in terms of candidate pools, revision schedules and whether they disclose these facts, or in other words in terms of revision transparency. Standard and Poor's and thus S&P 500 index is notorious for the lack of transparency as they do not disclose the candidate pool, exact selection criteria and they do not publish a predetermined schedule for revisions. As contrast, FTSE 100 index for example is composed quarterly from publicly disclosed pool of candidate companies based on their market cap and thus the transparency is very high.

If index composition is based on public information and public criteria, announcements of composition are essentially an easily forecastable formality which do not signal new information. The market should be able to incorporate the composition change into the price of affected stocks on a longer term beforehand instead of reacting rapidly to the announcement. Therefore, we should expect more significant abnormal price action around announcements in indices that have lower transparency and thus have an element of surprise in the announcement.

Contrary to this logic Chen (2006) and Gastineau (2002) assume that the index premium is due to arbitrageurs bidding the price up before indexers rebalance their portfolios and thus suggest that transparency of selection criteria in fact increases index premium. This view is somewhat puzzling from EMH point of view as it does not only assume that market is inefficient at incorporating information but also that it actively misprices assets when relevant information is revealed.

Petajisto (2011) finds that stocks added to Russell 2000 experienced on average 4.7% positive price impact from announcement to effective day while stocks deleted experienced average 4.6% negative price impact during 1990-2005. Russell 2000 is a market weighted stock index with fully transparent market cap-based selection criteria and therefore changes in its composition are highly predictable and free of information.

If the composition changes are known in advance, one could expect arbitrageurs front running indexers and each other to bid up the price before the announcement. This would smooth out the price increase over a longer period of time making it difficult to distinguish.

Most studies regarding index premium focus on S&P 500 and often even discuss about "S&P 500 effect" or something similar instead of index premium in general. However, when it comes to methodology S&P 500 differs from the mainstream to the extent that it is reasonable to assume it influencing how market reacts to revisions in it. From this perspective, studies which focus on more transparent indices become an important tool for evaluating theories explaining the index premium.

3.3.4 Level of Indexing

As there is strong empirical evidence for downward sloping demand curves and the debate focuses primarily on the reversal of price shocks caused by the excess demand from index tracking investors, the amount and proportion of capital following the index should have a direct effect the magnitude of the corresponding index premium. Morck and Yang (2001) find that the magnitude of the S&P 500 index premium rose along the increasing popularity of passive investing from 1987 to 1997. Similarly, Wurgler and Zhuravskaya (2002) find that the growth on the S&P 500 tracking capital rose from about 3% to over 8% of the total capitalization of the S&P 500 index during 1976-1996. Further, Petajisto (2011) finds that the index premium in the S&P 500 and Russell 2000 grew along with the popularity of indexing until 2000 but has declined since 2005.

The extent to which increase in the magnitude of index premium along with the portion of capitalization under passive investors' management during the last decades of the 20th century has a causal relationship as demand-based theories suggest is not easily testable.

Because passive investors do not engage in trading, level of indexing also affects liquidity adversely by reducing free float (Wurgler and Zhuravskaya, 2002) and thus the effect proposed by liquidity hypothesis.

3.3.5 Persistence of the Index Premium Phenomenon

If limits to arbitrage does not cover the entire index premium phenomenon, according to EMH such abnormality should decline or disappear due to arbitrageurs making the market more efficient. Many of the information-based theories also imply that advancement and utilization of information and communication technology in finance industry could have a diminishing effect on index premium.

Petajisto (2011) finds that the magnitude of abnormal price action around the S&P500 and Russel 2000 changes rose from 1990 to 2000 but has declined since and speculates that the increased price effect of index changes may have attracted arbitrageurs and made the market more efficient.

Synthetic indexing utilizes a mechanism for replicating the index that does not directly affect the demand for the underlying securities in an index. Emergence of synthetic indexing could thus have a diminishing effect on index premium in markets where synthetic indexing is popular.

Kamal, Lawrence, McCabe, and Prakash (2012) argue that information asymmetry may have declined in recent years and find that the magnitude of abnormal price action and excess liquidity around index revisions has declined since 2000, supporting this claim.

3.4 Index Turnover Cost

According to Lynch and Mendenhall (1997) announcing index composition changes before their implementation allows stocks to enter indices at already inflated prices and to exit them at deflated prices. Index funds benefit from this as their goal is to minimize the ‘tracking error’ regardless of returns but this results in a reduction in return of the index itself causing a hidden cost for investors who follow the index by investing in tracking error minimizing funds.

Index turnover cost is the reoccurring cost index funds (and the index itself) bear when a stock enters the index with index premium but exits with the price premium already discounted relative to an index-neutral strategy (Petajisto, 2011).

While index turnover cost can be estimated by comparing index returns to similar index-neutral strategy, Petajisto (2011) also provides a cleaner way of calculating index turnover costs for the S&P 500 and Russell 2000 indices. Index turnover cost for the S&P500 without price reversal is given by

$$\frac{p[s(a-d)+d]}{1+p} \tag{1}$$

and with reversal by

$$p\left(\frac{a+d}{1+p}\right). \tag{2}$$

Where p is the price premium, s is the share of stocks held by index-neutral fund, a is the share of market value of the index for stocks added throughout the year, and d is the share of market value of the index for stocks deleted.

According to Petajisto (2011), as Russell 2000 is rebalanced annually and transparently, its' index turnover cost can be estimated by comparing its' returns to that of a portfolio that is constructed using the same methodology but six months off cycle. As a result, Russell 2000 cash flow is given by

$$d(1-p)+d_t-a-a_t \tag{3}$$

where d and d_t are the "index value" of deletions due to falling below lower cutoff and rising above higher cutoff and a and a_t are the index value of additions from rising above lower cutoff and falling below higher cut-off.

Assuming that would be inclusions and deletions in Russell 2000 are evenly distributed across the year, cash flow from off-phase index-neutral portfolio is given by

$$\frac{1}{2}[d(1-p)+d_t-a-a_t]+\frac{1}{2}[d+d_t-a(1-p)-a_t], \tag{4}$$

and the difference of the two and hence the turnover cost without reversal by

$$\frac{p}{2}(a+d) \tag{5}$$

and with reversal by

$$p(a+d) \tag{6}$$

Using similar assumptions about the distribution of would be events, the formula in Eq. 4 can be used as is for estimating index turnover cost in semi-annually and quarterly reviewed indices with upper and lower cut-offs as well.

Deriving from Russel 2000 index turnover cost as in Petajisto (2011) the index turnover cost for transparent and mechanical index with only lower bound without reversal is given by

$$\frac{1}{2}[d(1-p)-a]+\frac{1}{2}[d-a(1-p)]-d(1-p)-a=\frac{ap+dp}{2} \tag{7}$$

and with reversal by

$$ap + dp. \tag{8}$$

Chen et al. (2006) assumes that the price impact of Russell 2000 composition changes is due to arbitrageurs and argues that index tracking investors would benefit from less transparency in the selection process. According to Pejatisto (2011), turnover cost in Russell 2000 is significantly larger than in the S&P 500 but assumes that this difference is due to mechanical indexers and to the fact that Russell 2000 is a small cap index.

4 DATA AND METHODOLOGY

4.1 Data

4.1.1 Indices and Events

This study incorporates events from Nordic blue-chip indices from OMX, Oslo Bors, MSCI, and FTSE as well as FTSE Nordic 30 index and MSCI Nordic countries small cap indices. The events are recorded manually from index review announcements available at research.ftserussell.com, nasdaqomxnordic.com, oslobors.no, and msci.com and from data provided by MSCI[1].

Altogether there are 819 events out of which 448 are inclusions and 372 are exclusions ranging from February 2008 to March 2020. Distribution of events across indices and countries is presented at table 1. Amount of distinct companies in the sample is 357 with 286 for inclusions and 242 for exclusions.

MSCI Nordic Large and Mid Cap Indices consist of 10 to 32 and capture 85% of the free float of each market while MSCI Nordic Small Cap Indexes consist of roughly 100 to 200 small cap stocks and account for 14% of each country's free float. Combined Small Cap and Large and Mid Cap Indices make up for MSCI Investable Market Index for each country. Together MSCI Nordic Large Cap Indices make up for the MSCI Nordic Countries composite index.

[1] *The MSCI data contained herein is the property of MSCI Inc.(MSCI). MSCI, its affiliates and its information providers make no warranties with respect to any such data. The MSCI data contained herein is used under license and may not be further used, distributed or disseminated without the express written consent of MSCI.*

Table 1 Distribution of Events Across Countries and Indices

	Total		Finland		Sweden		Denmark		Norway		Iceland	
Index	+	-	+	-	+	-	+	-	+	-	+	-
Total	448	372	52	55	141	90	77	70	157	140	21	17
OMXH25	10	5	10	5								
OMXS30	4	4			4	4						
OMXC20	26	23					26	23				
OMXI10	21	17									21	17
OBX	41	36							41	36		
MSCI Finland	0	6	0	6								
MSCI Sweden	11	11			11	11						
MSCI Denmark	10	8					10	8				
MSCI Norway	7	10							7	10		
MSCI Finland Small Cap	17	19	17	19								
MSCI Sweden Small Cap	111	59			111	59						
MSCI Denmark Small Cap	21	23					21	23				
MSCI Norway Small Cap	78	59							78	59		
FTSE Finland 25	23	22	23	22								
FTSE Sweden 30	11	13			11	13						
FTSE Denmark 20	14	12					14	12				
FTSE Norway 30	30	32							30	32		
FTSE Nordic 30	13	13	2	3	4	3	6	4	1	3		

MSCI Nordic Large and Mid Cap Indices consist of 10 to 32 and capture 85% of the free float of each market while MSCI Nordic Small Cap Indexes consist of roughly 100 to 200 small cap stocks and account for 14% of each country's free float. Combined Small Cap and Large and Mid Cap Indices make up for MSCI Investable Market Index for each country. Together MSCI Nordic Large Cap Indices make up for the MSCI Nordic Countries composite index. MSCI Indices are reviewed quarterly. Both the MSCI Nordic Index as well as each MSCI Investable Market Indices are followed by at least ETF's from Xtrackers and iShares but the extent to which individual MSCI Nordic Country Indices are followed by passive remains unclear. As a company crosses the upper boundary of Small Cap Index from below (above) it enters (exits) the MSCI Nordic Countries index but remains in the MSCI Investable Market Index. Therefore, inclusions and exclusions in which a stock crosses the upper boundary of a Small Cap Index are expected to have an effect inverse to events where stock crosses the lower bound. To correct for this, all such events are removed from Small Cap Indices but left in the Large Cap Indices. As a result, 29 inclusions and 20 exclusions are removed from MSCI Small Cap Indices leaving only 198 inclusions and 140 exclusions that cross the lower bound.

OMX indices as well as Oslo Børs's OBX are reviewed semi-annually on the last trading days of October and April and the changes are implemented on the first trading days of December and June. They consist of the most liquid stocks in each exchange measured by average trading volume over time. Thus, it is relatively easy to forecast inclusions and exclusions before the announcements with increasing confidence as announcement date comes closer. In OMX indices the price of the trading day previous to the date of implementation is used as basis for rebalancing. As a result, possibly inflated price at the day before implementation would decrease stock's weight in the index and thus the non-fundamental demand from passive investors. Assuming an index premium of some percentages at most, such reduction in the demand is unlikely to be significant. OMXC20 and OMXS30 all followed by at least one ETF's from Xact while OBX is followed by at least one ETF from Xact and one ETF from DNB. OMXH 25 is followed by at least one ETF from Seligson & Co.

Semi-annually reviewed FTSE Nordic Index Series consists of FTSE Nordic 30, Demark 20, Finland 25, and Sweden 30 indices and include the most liquid stocks of each market. FTSE Norway 30 has not been updated since 2017 and has been removed from the series. FTSE Norway 30 was followed by a Global X ETF until 2014 when it changed its target index to MSCI Norway IMI 25/50. FTSE Nordic 30 index is currently tracked by at least one Global X ETF.

4.1.2 Stock Returns

Price data for the stocks and OMX Nordic 120 and Nordic 40 indices are collected from investing.com. Events involving stocks of which's price data is unavailable or which's correct ISIN number cannot be determined are dropped. After dropping such events 400 inclusions and 323 exclusions remain.

This study uses daily closing prices for daily return calculation. Missing values in price data are dealt with by replacing corresponding missing values in stock returns with zeros. This is a statistically conservative method for dealing with random missing values arising from technical errors, exchanges being closed on holidays, or lack of trades in illiquid stocks and does not require further procedures as the quality of investing.com's data is generally reasonable. In addition to random missing values in the data, the data has an unfortunately high number of stocks that have long periods of price data missing. In cases where an event happens on such period the imputed zeros cause the entire event period cumulative abnormal returns to be zero. Such cases are dropped automatically at the end of each test while aggregating the results. The final number of events with corresponding price data for each test are presented in their statistics.

4.2 Event Study

An event study is a methodology for statistical testing of the effects of some events on asset prices or other metrics and was first developed by Fama, Fischer, Jensen and Roll (1969). Event studies typically use some statistical or economic model to estimate expected returns of assets and derive abnormal returns based on the difference of expected and observed returns. By excluding the event from estimation period, its' possible effect on asset prices should be observable from the abnormal returns around the time of the event. To achieve statistical power, event studies event studies pool together multiple assets that have experienced a similar event and aggregate the abnormal returns relative to the time of the events. Cumulative mean abnormal returns are then used to examine the effect of the event. Because event studies generally examine the impact of an event only on a short timeframe, their results are not as sensitive to the quality of the model used.

While the body of empirical literature in finance and economics using event studies is large and wide ranging, in finance typical use case for an event study is examination of markets response and assimilation of new information. This relates to

EMH in a sense that semi-strong form of efficiency or event study as Fama (1991) prefers it, suggests that all public information should be perfectly incorporated into prices by the market and events where private information is made public prices should jump into their 'correct' levels immediately. Thus, a strict interpretation of EMH suggests that event studies examining publication of private information should find flat abnormal returns leading to the event and studies examining events based on public information, such as revision of transparent index, should find flat abnormal returns altogether.

4.2.1 Event dates and windows

Following Lynch and Mendenhall (1997), this study uses the event study methodology with two event dates, announcement (AD) and effective date (CD), for each inclusion and exclusion. The date the announcement is published is considered AD as due to transparent rules in the examined indices the content of the announcement is expected to be known in advance. Similarly, CD is taken as the date at the beginning of which the change is implemented as that is the date ETF's are likely to rebalance their portfolios.

Following Mackinlay (1997), the event study is conducted by indexing abnormal returns in event time by setting event time as t = 0 and setting t = $T_1 + 1$ to t = T_2 as the event window. Thus, the length of the event window is $L_1 = T_1 - T_0$ and the length of the post-event window is $L_2 = T_2 - T_1$.

This study uses 7-day event window (-3:3) around the event dates in standard short-term event study. Following Lynch and Mendenhall (1997) this study also explores five longer windows on a range from AD to CD - 10 to capture behaviour of the possible index premium. Rather than using standard event study methodology at a longer event window, such deviation is necessary to control cumulation of possible biases in abnormal returns and because the number of days between AD and CD varies from 5 to 31. Longer windows are explored by comparing their average abnormal returns based the number of days in each period for each stock. Run-up window from AD + 1 to CD -1 captures the returns stocks gain during the period between publication and effective day. Release window runs for CD to CD + 7 for inclusions and CD + 5 for exclusions. Release window captures the reversal of price pressure from the effective day as assumed by the price pressure hypothesis. The length of the release window is based on the estimation on trading volume's normalization from Lynch and Mendenhall (1997). Post-release window runs from the day after release window (CD + 8, CD + 6) to ten days after the effective day (CD + 10). Post-AD permanent 1 runs from AD + 1 to CD + 7 (CD + 5 for exclusions), consisting of run-up and release windows, while Post-AD permanent 2 adds post-release window and runs from AD + 1 to CD + 10. Total permanent 1 and 2 only add the announcement day to post-AD permanent windows and thus run from AD to CD + 7 (CD + 5 for exclusions) and AD to CD + 10.

Following on Lynch and Mendenhall (1997) table 2 presents the period returns as expected by the theoretical framework.

Table 2 **Prediction of Hypotheses for Event Days and Event Windows**

	Event Day - CAR		Windows - MCAR				
Hypotheses	AD	CD - 1	Run-up	Post-AD Permanent	Total Permanent	Release	Post-Release
Price-pressure w/ no anticipation	0	+	+	0	0	-	0
Price-pressure w/ anticipation	+	0	0	-	0	-	0
Imperfect substitutes w/ no anticipation	0	+	+	+	+	0	0
Imperfect substitutes w/ anticipation	+	0	0	0	+	0	0
Information	+	0	0	0	+	0	0
Liquidity	+	0	0	0	+	0	0
Invstor awareness	+	0	0	0	+	0	0

The predictions presented are for inclusions. Predictions for exclusions would be exact opposites except for investor awareness hypothesis which predicts no effects for exclusions.

4.2.2 Abnormal returns

Following Lynch and Mendenhall (1997), the abnormal returns are calculated by subtracting index returns from stocks' raw returns. The index used in calculating abnormal returns for large and mid cap stocks is OMX Nordic 120 which consists of

120 largest and most liquid stocks traded in OMX Helsinki, OMX Stockholm, OMX Copenhagen, and in Oslo Børs. Abnormal returns for stocks included in MSCI Nordic Country Small Cap Indices are calculated by subtracting OMX Nordic Small Cap PI returns from them. The indices consist of similar stocks as the indices studied but is rebalanced at different dates and is thus likely to give a reasonable benchmark about general performance of Nordic stock markets during the event periods without distorting the results.

While this deviation from standard event study format where abnormal returns are calculated using a pricing model is not sophisticated, it has properties that especially benefit this study. First, it removes the need for an estimation period. This in beneficial because of the large amount of missing data and because of the multiple event dates. By the nature of the indices studied, stocks in the sample are likely to have outperformed the index prior to inclusion and respectively underperformed prior to exclusion, most pricing models would result in bias toward a higher (lower) alpha coefficient when the estimation period precedes inclusion (exclusion). With inclusions this problem could be avoided by using a very long estimation period, but which might become another problem with exclusions unless each stock has had very little index related activity during that period, an unlikely assumption. In fact, as the changes in stocks' volume and companies' market caps are likely to lead to similar events in various Nordic indices the supposed index premia may make the data around events generally "noisy" when considering each individual event. Second, the index captures cross correlation in stocks and thus removes the necessity of batching events with the same dates and of additional statistical procedures where event periods overlap. This conserves the amount of events and allows filtering the data more specifically.

The main drawback of this method is that it does not capture the momentum in the stocks that lead to index events. Thus, stock specific momentum is included in the abnormal returns which may lead to bias in event study results. Caution is required when making inferences especially if the event period is long.

Following Mackinlay (1997) abnormal return (CAR) is defined as $CAR_i(t_1, t_2)$, from t_1 to t_2, where $T_1 < t_1 \leq t_2 \leq T_2$ by

$$CAR_i(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{it}. \tag{9}$$

Cumulative abnormal returns are aggregated across the sample by

$$\overline{CAR}(t_1, t_2) = \sum_{t=t_1}^{t_2} \overline{AR_t}, \tag{10}$$

$$\sigma\left(\overline{CAR}(t_1, t_2)\right) = \left[\sum_{t=t_1}^{t_2} \sigma^2(\overline{AR_t})\right]^{\frac{1}{2}} \tag{11}$$

where

$$\sigma^2(\overline{AR_t}) = \frac{1}{N^2}\sum_{i=1}^{N} \sigma_{\varepsilon_i}^2. \tag{12}$$

Following Lynch and Mendenhall (1997), as this study uses two event dates per sample which have varying trading days between them, an average abnormal return (AAR) in addition to simple CAR is needed to evaluate periods of AD to CD. $AAR(t_1, t_2)$ is simply $\overline{CAR}(t_1, t_2)$ for the window divided by the number of days in the period. Different event windows are compared against each other using means of $AAR(t_1, t_2)$, denoted as $MAAR(t_1, t_2)$ and of the sum of abnormal returns in the window denoted as $MCAR(t_1, t_2)$. In cases where the period between AD and CD is long MCAR will be excessively high or low due to stocks momentum seeping in into abnormal returns. Similarly, MAAR will get higher values when the period between AD and CD is short and the premium cumulates faster. Together these metrics allow robust interpretation of results for windows which include the run-up period.

4.3 Subsetting and Tests

In addition to running the event study with long term window analysis on the entire sample the data is subset into three more specific samples based on index characteristics in an attempt to capture drivers of index premium.

The first subsample consists of events where stocks cross the lower boundary in MSCI Nordic Country Small Cap Indices. According to Petajisto (2011), small cap indices are more likely to have high index premium. Such assumption is supported by liquidity, investor awareness, and information hypotheses but small cap stocks may also be more likely to show a price reaction to mechanical excess demand from indexers. Events where stocks cross the upper boundary are excluded because in such cases the stock is included in or excluded from the respective MSCI Country Large a Mid Cap Index and thus such events are expected to have an opposite effect to 'normal' exclusions and inclusions.

The second subsample consists of MSCI Nordic Country Indices which together form the MSCI Nordic Countries Index and of FTSE Nordic 30 index. These indices are assumed to be the most liquid and to have the most amount of capital tracking them. As a region Nordics are more comparable to larger developed economies in Europe and thus region indices and products built upon them can be assumed to be more accessible to foreign investors and capital.

The third subsample consists of all country specific blue-chip indices. While some of them are tracked by ETFs, membership in a country blue chip index is likely to have relatively large informational value. Thus, testing a sample of only blue-chip indices is likely to give cleanest look at information based price effects.

Finally, for each test the development of index premium over time is explored by dividing the events into four batches of three years based on announcement year. Events from 2020 are included in the fourth batch. Mean cumulative abnormal returns for each event type and day are reported for each batch. Statistical significances of subsample mean cumulative abnormal returns are calculated with one-sided t-tests and two-sided t-tests against the mean of the entire period mean abnormal returns of each event type and day. When MCAR and one-sided t1-statistics are close to zero, t2-statistic confirms whether MCAR differs from the entire sample.

5 RESULTS

5.1 Total Sample

Table 3 presents results for the total sample short term event study. Overall the results seem to support existence of index premium in Nordic stock markets but only at a magnitude that supports practical implications of EMH. Inclusion announcement appears to cause a modest, roughly 1% price increase that is statistically significant for the following days. Less than 60% of stocks in the sample present positive mean abnormal return for the period. The results for inclusion effective day show modest but mostly statistically insignificant price premium. Surprisingly and contrary to earlier empirical findings, a price decline that is larger in magnitude to that of inclusion announcement is found around exclusion announcement. Findings about exclusions are mostly statistically insignificant but possibly show a sharp decline in price at days -1 and 0 followed by sharp reversal, possibly showing signs of price pressure.

Table 4 and table 5 present long window results for total sample inclusions and exclusions. All long-term windows for inclusions with the exception of release and post-release windows show similar roughly 2% total price increase measured by MCAR suggesting that most of the price premium cumulates between announcement and effective day. This is to an extent supported by the results in MAAR, although the relatively stable MAAR ranging from .07% to .1% might indicate that prices increase steadily across all windows and that relatively high MCAR in run-up window is due to its long length ranging from 5 to 30 days. Release and post-release windows for inclusions fail to capture a short-term price reversal supporting long-term downward sloping demand curves (imperfect substitutes) or information-based theories.

Long window results for total sample exclusions also show that most of the price impact takes place within run-up period. However, a positive reversal, although not statistically significant, is observed in release and post-release periods. Moderately higher MAAR for run-up period relative to longer periods supports this finding. These results imply possible price pressure around effective days for exclusions.

Table 3 **Daily Market-Adjusted Abnormal Returns (AR) for Firms Added and Deleted from Nordic Indices**

	Additions N = 339						Deletions N = 281					
	AD = 0:			CD = 0			AD = 0:			CD = 0		
Event Day	CAR	t(CAR)	% > 0	CAR	t(CAR)	% > 0	CAR	t(CAR)	% > 0	CAR	t(CAR)	% > 0
-5	0.11 %	0.83	47.93 %	0.21 %	1.55	48.08 %	-0.24 %	-1.34	43.73 %	0.25 %	1.41	45.71 %
-4	-0.02 %	-0.09	43.79 %	0.14 %	0.74	46.61 %	-0.36 %	-1.24	45.52 %	0.59 %	2.27	47.50 %
-3	-0.19 %	-0.70	49.41 %	0.47 %	2.06	53.10 %	-0.54 %	-1.61	44.44 %	0.41 %	1.29	51.07 %
-2	0.09 %	0.31	52.96 %	0.70 %	2.81	59.29 %	-0.67 %	-1.70	46.24 %	-0.07 %	-0.19	49.29 %
-1	0.12 %	0.36	53.25 %	0.52 %	1.86	54.57 %	-1.06 %	-2.16	42.65 %	-1.16 %	-2.49	47.50 %
0	0.18 %	0.50	52.07 %	0.37 %	1.15	56.64 %	-1.29 %	-2.23	43.73 %	-0.73 %	-1.53	49.64 %
1	0.82 %	2.15	57.10 %	0.40 %	1.13	54.57 %	-1.63 %	-3.33	41.22 %	-0.67 %	-1.40	48.57 %
2	0.91 %	2.29	57.10 %	0.58 %	1.67	52.21 %	-2.17 %	-3.95	41.94 %	-0.43 %	-0.88	49.64 %
3	0.89 %	2.20	56.21 %	0.62 %	1.72	54.28 %	-2.17 %	-3.73	42.65 %	-0.24 %	-0.45	52.50 %
4	1.07 %	2.44	57.99 %	0.48 %	1.23	55.75 %	-2.02 %	-3.33	43.73 %	-0.50 %	-0.87	53.93 %
5	1.13 %	2.50	55.92 %	0.26 %	0.66	54.57 %	-2.47 %	-3.80	43.01 %	-0.41 %	-0.69	52.14 %

This table presents the mean cumulative abnormal returns from days -5:5 relative to event dates (AD for announcements, CD for effective days). T-statistic is for one-sided test against zero. '% > 0' presents the percentage of positive cumulative abnormal returns. The sample contains additions and deletions from FTSE Norway 30, FTSE Sweden 30, FTSE Finland 25, FTSE Denmark 20, MSCI Nordic Countries composite index, MSCI Nordic Countries Small Cap Indices, OMXH25, OMXS30, OMXC25,OMXI10, and OBX from February 2008 to January 2020. Events where the stock crosses the upper boundary of a MSCI Small Cap Index are deleted from it and the corresponding MSCI Standard Country Index.

Table 4 **Long Window Statistics for Total Sample Inclusion Daily Market-Adjusted Returns**

Specific Event Window	Event Days	N	MCAR	t	% > 0
Run-up	AD + 1, CD - 1	339	1.79 %	4.06	57.52 %
Post-AD Permanent	AD + 1, CD + 7	340	1.90 %	3.47	57.23 %
	AD + 1, CD + 10	340	1.90 %	3.18	56.64 %
Total Permanent	AD, CD + 7	340	1.97 %	3.57	56.34 %
	AD, CD + 10	340	1.96 %	3.27	57.23 %
Release	CD, CD + 7	339	0.12 %	0.36	51.18 %
Post-release	CD + 8, CD + 10	334	-0.01 %	-0.03	50.15 %
		N	MAAR	t	% > 0
Run-up	AD + 1, CD - 1	339	0.10 %	3.72	58.11 %
Post-AD Permanent	AD + 1, CD + 7	340	0.07 %	3.88	57.23 %
	AD + 1, CD + 10	340	0.06 %	3.82	57.52 %
Total Permanent	AD, CD + 7	340	0.07 %	3.98	59.59 %
	AD, CD + 10	340	0.06 %	3.92	59.29 %

MCAR presents the mean of cumulative abnormal returns for given period. MAAR presents the average of abnormal returns divided by the number of days in the period. t is one-sided t-test where CARs are tested against zero.

Table 5 **Long Window Satistics for Total Sample Exclusion Daily Market-Adjusted Returns**

Specific Event Window	Event Days	N	MCAR	t	% > 0
Run-up	AD + 1, CD - 1	280	-2.55 %	-4.09	43.93 %
Post-AD Permanent	AD + 1, CD + 5	281	-1.80 %	-2.50	45.36 %
	AD + 1, CD + 10	282	-1.59 %	-1.60	42.50 %
Total Permanent	AD, CD + 5	281	-2.02 %	-2.58	45.71 %
	AD, CD + 10	282	-1.81 %	-1.75	42.14 %
Release	CD, CD + 5	280	0.74 %	1.56	54.12 %
Post-release	CD + 6, CD + 10	281	0.20 %	0.28	49.46 %
		N	MAAR	t	% > 0
Run-up	AD + 1, CD - 1	280	-0.09 %	-2.46	44.29 %
Post-AD Permanent	AD + 1, CD + 5	281	-0.08 %	-3.19	46.79 %
	AD + 1, CD + 10	282	-0.07 %	-3.22	46.79 %
Total Permanent	AD, CD + 5	281	-0.08 %	-3.00	44.29 %
	AD, CD + 10	282	-0.07 %	-3.08	45.36 %

MCAR presents the mean of cumulative abnormal returns for given period. MAAR presents the average of abnormal returns divided by the number of days in the period. t is one-sided t-test where CARs are tested against zero.

Table 6 shows average MCARs and statistics for -5:5 event periods by 3-4-year periods. Most of the t1-statistics are significant at 5% confidence level with significant MCARs signalling mild positive mean cumulative abnormal returns for periods around inclusion announcement and effective day. MCARs for exclusion announcement have steadily increased toward zero. Period around exclusion effective day has statistically significant ~2.5% price decline in 2008-2010 as measured by t1 and t2 statistics, but for the following periods are statistically indistinguishable from zero or from each other.

Table 6			Total Sample Index Premium Over Time					
	Inclusions							
	AD = 0, -5:5				CD = 0, -5:5			
Years	**N**	**MCAR**	**t1**	**t2**	**N**	**MCAR**	**t1**	**t2**
2008-2010	42	-0.62 %	-2.23	-3.65	43	0.58 %	1.77	0.43
2011-2013	64	-0.20 %	-0.80	-2.46	64	0.45 %	2.38	0.10
2014-2016	132	0.70 %	4.35	1.24	133	0.78 %	5.87	2.12
2017-2020	95	1.15 %	5.69	3.02	94	-0.17 %	-0.89	-2.86
	Exclusions							
	AD = 0, -5:5				CD = 0, -5:5			
Years	**N**	**MCAR**	**t1**	**t2**	**N**	**MCAR**	**t1**	**t2**
2008-2010	39	-3.17 %	-6.92	-3.82	38	-2.52 %	-4.30	-3.74
2011-2013	75	-1.92 %	-5.85	-1.64	75	0.20 %	0.83	1.70
2014-2016	88	-0.88 %	-3.73	1.59	88	-0.08 %	-0.39	0.76
2017-2020	73	-0.66 %	-2.71	2.37	74	-0.01 %	-0.05	1.02

MCAR presents the mean of cumulative abnormal returns for given period. t1 is one-sided t-test where CARs are tested against zero. In t2 CARs are tested against total period CARs.

5.2 Small Caps

Table 7 presents the event study results for MSCI Nordic Small Cap Indices. The inclusion announcement is followed by a relatively sharp increase in cumulative abnormal returns on day 1 and continues to increase slightly during the following days. Results for inclusion effective day are mostly insignificant. Cumulative returns around the exclusion announcement decline steadily to an average of -5% at day 5 and are mostly statistically significant at 5% confidence level. Results for effective day of exclusion are mostly statistically insignificant but hint at a sharp drop in price at day -1 and a reversal at day 0.

MSCI indices are constructed transparently and thus radical price reaction to announcements would not be expected. The fact that regardless of apparent transparency forecasting MSCI Small Cap Indices changes is unattainable for most investors may explain the mild observed price reaction via anticipation of indexing related excess demand and information-based theories. Similar reaction to exclusion announcement is not observed but instead abnormal returns decline steadily and with large magnitude. Sharp decline and reversal at exclusion effective day hints at existence of price pressure with release beginning at CD for small cap stocks.

Tables 8 and 9 present long window results for small cap inclusions and exclusion. For inclusions most of the abnormal returns cumulate during run-up period and no reversal is observed. Larger portion of abnormal returns are positive for all periods when compared to total sample returns. Economically and statistically significant negative abnormal return cumulates over exclusions run-up period roughly half of which is reversed during release period. Results presented at tables 8 and 9 support price pressure hypothesis for exclusions but not for inclusions.

The fact that results for exclusion show price pressure but the results for inclusions do not is peculiar. Previous literature does not offer direct explanation on why the behaviour would be se different for different kinds of events nor does it show similar empirical findings in terms of inclusions and exclusions behaving this way or of such relative magnitude where exclusions appear to cause larger effect.

Table 7 **Daily Market-Adjusted Abnormal Returns (AR) for Firms Added and Deleted from Nordic Small Cap Indices**

	Additions N = 152						Deletions N = 101					
	AD = 0:			CD = 0			AD = 0:			CD = 0		
Event Day	CAR	t(CAR)	% > 0	CAR	t(CAR)	% > 0	CAR	t(CAR)	% > 0	CAR	t(CAR)	% > 0
-5	0.34 %	1.68	51.32 %	0.12 %	0.67	43.71 %	-0.45 %	-1.24	44.44 %	-0.23 %	-1.04	35.00 %
-4	0.38 %	1.24	48.68 %	0.17 %	0.69	45.03 %	-0.85 %	-1.36	36.36 %	-0.42 %	-1.13	37.00 %
-3	0.03 %	0.05	53.95 %	0.46 %	1.50	52.98 %	-1.33 %	-1.80	37.37 %	-0.55 %	-1.03	46.00 %
-2	0.07 %	0.14	55.92 %	1.04 %	2.96	62.25 %	-1.66 %	-1.99	37.37 %	-1.29 %	-1.66	43.00 %
-1	0.21 %	0.39	55.26 %	0.89 %	2.10	54.97 %	-2.15 %	-1.92	39.39 %	-3.21 %	-3.09	39.00 %
0	0.32 %	0.53	51.97 %	0.67 %	1.38	58.94 %	-2.67 %	-1.98	38.38 %	-2.08 %	-2.05	38.00 %
1	1.60 %	2.41	61.18 %	0.93 %	1.80	57.62 %	-3.45 %	-3.63	28.28 %	-1.60 %	-1.64	45.00 %
2	1.91 %	2.98	63.16 %	0.97 %	1.83	54.97 %	-4.21 %	-3.78	30.30 %	-1.46 %	-1.47	43.00 %
3	1.85 %	2.77	60.53 %	1.03 %	1.84	55.63 %	-4.01 %	-3.53	32.32 %	-1.36 %	-1.28	46.00 %
4	2.16 %	2.99	61.18 %	1.11 %	1.86	57.62 %	-4.13 %	-3.48	32.32 %	-1.05 %	-0.90	52.00 %
5	2.49 %	3.40	62.50 %	0.77 %	1.26	55.63 %	-5.00 %	-3.93	31.31 %	-0.44 %	-0.39	52.00 %

This table presents the mean cumulative abnormal returns from days -5:5 relative to event dates (AD for announcements, CD for effective days). T-statistic is for one-sided test against zero. '% > 0' presents the percentage of positive cumulative abnormal returns. The sample contains additions and deletions from MSCI Nordic Small Cap Indices. Upper boundary crossing events are removed.

Table 8 **Long Window Statistics for Small Cap Inclusions Daily Market-Adjusted Returns**

Specific Event Window	Event Days	N	MCAR	t	% > 0
Run-up	AD + 1, CD - 1	152	3.46 %	4.98	66.45 %
Post-AD Permanent	AD + 1, CD + 7	152	3.89 %	4.58	66.45 %
	AD + 1, CD + 10	152	3.96 %	4.24	63.82 %
Total Permanent	AD, CD + 7	152	4.00 %	4.62	62.50 %
	AD, CD + 10	152	4.07 %	4.24	63.82 %
Release	CD, CD + 7	151	0.43 %	0.89	49.67 %
Post-release	CD + 8, CD + 10	151	0.07 %	0.24	51.66 %
		N	MAAR	t	% > 0
Run-up	AD + 1, CD - 1	152	0.19 %	5.56	69.08 %
Post-AD Permanent	AD + 1, CD + 7	152	0.14 %	5.37	66.45 %
	AD + 1, CD + 10	152	0.13 %	5.25	67.11 %
Total Permanent	AD, CD + 7	152	0.13 %	5.37	69.74 %
	AD, CD + 10	152	0.12 %	5.25	71.05 %

MCAR presents the mean of cumulative abnormal returns for given period. MAAR presents the average of abnormal returns divided by the number of days in the period. t is one-sided t-test where CARs are tested against zero.

Table 9 **Long Window Satistics for Small Cap Exclusions Daily Market-Adjusted Returns**

Specific Event Window	Event Days	N	MCAR	t	% > 0
Run-up	AD + 1, CD - 1	100	-6.26 %	-5.07	28.00 %
Post-AD Permanent	AD + 1, CD + 5	101	-3.39 %	-2.67	38.00 %
	AD + 1, CD + 10	101	-3.98 %	-2.62	36.00 %
Total Permanent	AD, CD + 5	101	-3.91 %	-2.65	36.00 %
	AD, CD + 10	101	-4.50 %	-2.68	37.00 %
Release	CD, CD + 5	100	2.84 %	3.11	65.66 %
Post-release	CD + 6, CD + 10	100	-0.60 %	-0.81	52.53 %
		N	MAAR	t	% > 0
Run-up	AD + 1, CD - 1	100	-0.23 %	-3.55	33.00 %
Post-AD Permanent	AD + 1, CD + 5	101	-0.18 %	-4.14	35.00 %
	AD + 1, CD + 10	101	-0.15 %	-3.96	35.00 %
Total Permanent	AD, CD + 5	101	-0.19 %	-3.87	28.00 %
	AD, CD + 10	101	-0.16 %	-3.70	29.00 %

MCAR presents the mean of cumulative abnormal returns for given period. MAAR presents the average of abnormal returns divided by the number of days in the period. t is one-sided t-test where CARs are tested against zero.

Development of small cap index premium is presented in table 10. MCAR for 2008-2010 period inclusion announcement is surprisingly negative and statistically significant. Most of the negative MCAR derives from two stocks that appear to have declined ~26% and ~15% during the event period. However, as CARs deviate much during 2008-2010 and there are similar outlierish observations to the upside as well, doctoring the data by removing the strongly negative values cannot be justified. Regardless of high t-statistics, this result should not be considered significant. Similarly, the strongly negative result for 2008-2010 is based on only 15 events and probably not reliable regardless of the high t-statistics. Probable explanation for the very high t-values is that they are calculated using each day return from each event as an observation. Zeros imputed in place of missing values in stock return calculation cause cumulative abnormal return to remain the same on days for which prior day stock price was missing from the initial data. As a result, data points which are surrounded by missing values can constitute as up to eleven observations. It is possible that the small cap stocks in the sample were illiquid and volatile during 2008-2010. Therefore, a high N should be considered a requirement for significance in these tests.

Table 10 **Small Cap Index Premium Over Time**

	Inclusions							
	AD = 0, -5:5				**CD = 0, -5:5**			
Years	N	MCAR	t1	t2	N	MCAR	t1	t2
2008-2010	23	-2.01 %	-6.22	-8.29	23	1.90 %	4.74	2.73
2011-2013	22	1.69 %	3.72	1.35	22	1.32 %	4.27	1.70
2014-2016	59	0.91 %	3.18	-0.35	59	0.51 %	2.91	-1.05
2017-2020	43	2.28 %	6.67	3.25	42	0.02 %	0.07	-2.06
	Exclusions							
	AD = 0, -5:5				**CD = 0, -5:5**			
Years	N	MCAR	t1	t2	N	MCAR	t1	t2
2008-2010	16	-2.52 %	-3.33	0.24	15	-8.04 %	-9.15	-7.39
2011-2013	27	-2.81 %	-3.90	-0.11	27	0.23 %	0.47	2.62
2014-2016	27	-2.77 %	-4.99	-0.08	27	-0.91 %	-1.95	0.62
2017-2020	25	-2.50 %	-5.37	0.39	26	0.37 %	0.87	3.23

MCAR presents the mean of cumulative abnormal returns for given period. t1 is one-sided t-test where CARs are tested against zero. In t2 CARs are tested against total period CARs.

5.3 Nordic Region

Table 11 presents event study results for MSCI Nordic Countries Index and FTSE Nordic 30. A positive and a negative price effects take place around inclusion and exclusion announcements, both being mostly significant as measured by t-statistic. The economic magnitude of exclusion announcement is about twice as large as of inclusion announcement. Surprisingly, exclusion effective day is preceded and followed by economically significant positive cumulative abnormal returns that at some points are significant also statistically. In fact, the results might be interpreted to show a drop from elevated values and a reversal at day 1. Although there is no clear explanation for positive abnormal returns few days before exclusion effective day, the reversal supports price pressure hypothesis. However, the effective day for inclusion shows no abnormalities.

Table 12 presents long window results for region indices inclusions and table 13 for exclusions. All long window results for inclusions are flat and statistically insignificant indicating that the ~2% premium that has cumulated at day 0 relative to announcement remains in the price for the entire period until CD + 10. The results for exclusions are similar except for ~6.5% positive abnormal return in post-release period, which is not statistically significant. Results for these region indices show support for long-term downward sloping demand curves with anticipation and for information-based theories, but the peculiar result for exclusions post-release period potentially undermines this conclusion. However, the fact that the negative abnormal returns during exclusion announcement period are much larger than the positive abnormal returns at inclusion announcement contradicts with investor awareness hypothesis.

Table 11 **Daily Market-Adjusted Abnormal Returns (AR) for Firms Added and Deleted from Nordic Region Indices**

	Additions N = 35						Deletions N = 38					
		AD = 0:			CD = 0			AD = 0:			CD = 0	
Event Day	CAR	t(CAR)	% > 0	CAR	t(CAR)	% > 0	CAR	t(CAR)	% > 0	CAR	t(CAR)	% > 0
-5	-0.39 %	-0.73	41.18 %	1.29 %	2.57	62.86 %	-1.15 %	-1.92	35.14 %	1.58 %	2.02	54.05 %
-4	-0.03 %	-0.06	41.18 %	0.86 %	1.38	57.14 %	-1.16 %	-1.23	45.95 %	3.04 %	2.68	67.57 %
-3	0.52 %	0.72	50.00 %	1.07 %	1.23	54.29 %	-0.44 %	-0.53	48.65 %	2.64 %	2.11	59.46 %
-2	1.66 %	2.01	64.71 %	1.03 %	1.36	54.29 %	-0.47 %	-0.44	51.35 %	1.93 %	1.54	62.16 %
-1	1.45 %	1.79	61.76 %	-0.21 %	-0.26	51.43 %	-1.98 %	-2.00	45.95 %	1.34 %	1.17	62.16 %
0	2.18 %	2.59	67.65 %	-0.39 %	-0.49	45.71 %	-2.60 %	-2.36	40.54 %	1.14 %	0.83	67.57 %
1	2.13 %	2.55	70.59 %	-0.86 %	-0.89	37.14 %	-2.61 %	-1.74	37.84 %	0.88 %	0.57	59.46 %
2	2.04 %	2.10	70.59 %	-0.19 %	-0.23	40.00 %	-3.42 %	-2.19	37.84 %	2.10 %	1.32	56.76 %
3	1.94 %	1.91	61.76 %	0.15 %	0.16	51.43 %	-4.83 %	-2.89	35.14 %	3.70 %	2.20	70.27 %
4	2.46 %	2.10	70.59 %	-0.69 %	-0.62	51.43 %	-4.13 %	-2.31	37.84 %	2.04 %	1.05	62.16 %
5	1.64 %	1.33	61.76 %	-0.89 %	-0.73	54.29 %	-4.23 %	-2.06	43.24 %	0.48 %	0.22	56.76 %

This table presents the mean cumulative abnormal returns from days -5:5 relative to event dates (AD for announcements, CD for effective days). T-statistic is for one-sided test against zero. '% > 0' presents the percentage of positive cumulative abnormal returns. The sample contains additions and deletions from MSCI Nordic Countries Large and Mid Cap Indices and FTSE Nordic 30.

Table 12 **Long Window Statistics for Region Inclusions Daily Market-Adjusted Returns**

Specific Event Window	Event Days	N	MCAR	t	% > 0
Run-up	AD + 1, CD - 1	36	-0.07 %	-0.06	47.22 %
Post-AD Permanent	AD + 1, CD + 7	36	-0.60 %	-0.28	50.00 %
	AD + 1, CD + 10	36	-0.10 %	-0.04	50.00 %
Total Permanent	AD, CD + 7	36	0.31 %	0.15	52.78 %
	AD, CD + 10	36	0.82 %	0.37	58.33 %
Release	CD, CD + 7	36	-0.53 %	-0.40	52.78 %
Postrelease	CD + 8, CD + 10	35	0.52 %	0.74	51.43 %
		N	MAAR	t	% > 0
Run-up	AD + 1, CD - 1	36	0.01 %	0.07	47.22 %
Post-AD Permanent	AD + 1, CD + 7	36	-0.02 %	-0.29	41.67 %
	AD + 1, CD + 10	36	-0.02 %	-0.35	44.44 %
Total Permanent	AD, CD + 7	36	0.02 %	0.41	47.22 %
	AD, CD + 10	36	0.02 %	0.31	47.22 %

MCAR presents the mean of cumulative abnormal returns for given period. MAAR presents the average of abnormal returns divided by the number of days in the period. t is one-sided t-test where CARs are tested against zero.

Table 13 **Long Window Satistics for Region Exclusions Daily Market-Adjusted Returns**

Specific Event Window	Event Days	N	MCAR	t	% > 0
Run-up	AD + 1, CD - 1	37	0.43 %	0.21	59.46 %
Post-AD Permanent	AD + 1, CD + 5	37	-0.43 %	-0.15	54.05 %
	AD + 1, CD + 10	37	6.10 %	1.13	56.76 %
Total Permanent	AD, CD + 5	37	-1.06 %	-0.35	51.35 %
	AD, CD + 10	37	5.47 %	1.01	51.35 %
Release	CD, CD + 5	37	-0.86 %	-0.48	45.95 %
Postrelease	CD + 6, CD + 10	37	6.53 %	1.36	67.57 %
		N	MAAR	t	% > 0
Run-up	AD + 1, CD - 1	37	-0.03 %	-0.29	45.95 %
Post-AD Permanent	AD + 1, CD + 5	37	0.02 %	0.16	64.86 %
	AD + 1, CD + 10	37	0.03 %	0.34	67.57 %
Total Permanent	AD, CD + 5	37	-0.03 %	-0.29	64.86 %
	AD, CD + 10	37	0.00 %	-0.04	64.86 %

MCAR presents the mean of cumulative abnormal returns for given period. MAAR presents the average of abnormal returns divided by the number of days in the period. t is one-sided t-test where CARs are tested against zero.

Table 14			Region Index Premium Over Time					
				Inclusions				
		AD = 0, -5:5				CD = 0, -5:5		
Years	N	MCAR	t1	t2	N	MCAR	t1	t2
2008-2010	10	1.40 %	2.21	-0.03	10	0.10 %	0.24	0.00
2011-2013	4	1.81 %	2.10	0.43	4	0.71 %	1.03	0.82
2014-2016	13	1.37 %	3.57	-0.11	13	0.05 %	0.09	-0.09
2017-2020	3	3.71 %	7.87	4.22	3	1.56 %	2.88	2.41
				Exclusions				
		AD = 0, -5:5				CD = 0, -5:5		
Years	N	MCAR	t1	t2	N	MCAR	t1	t2
2008-2010	15	-3.31 %	-4.85	-1.07	14	2.10 %	2.16	0.19
2011-2013	7	-1.47 %	-1.44	0.90	7	4.65 %	5.69	2.95
2014-2016	6	-5.05 %	-6.49	-2.95	6	1.73 %	2.33	-0.19
2017-2020	4	-3.17 %	-3.27	-0.68	4	0.50 %	1.05	-2.15

MCAR presents the mean of cumulative abnormal returns for given period. t1 is one-sided t-test where CARs are tested against zero. In t2 CARs are tested against total period CARs.

5.4 Country Blue Chips

Tables 15, 16, and 17 show the short-term event study and long window results for inclusions and exclusions from all the blue-chip indices. The results show both economically and statistically insignificant abnormal returns with the exception of some values here and there. Overall the event study does not capture any sign of index premium or abnormal behaviour of prices around Nordic blue-chip index composition changes. This is puzzling because many of those indices are tracked by at least some capital and membership in them can be assumed to have positive informational value. Previous literature and empirical evidence suggest that such properties generate an index premium that arbitrageurs exploit only to the extent at which it provides opportunity for risk adjusted excess returns. If a detectable component of index premium is explained by idiosyncratic risk as Wurgler and Zhuravskaya (2002) and Petajisto (2011) suggest, then failing to detect any index premium in Nordic blue-chip indices raises the question whether the idiosyncratic risk around index composition changes is so small that arbitrageurs eliminate the premium completely or if those changes generate premium at all.

Table 15 **Daily Market-Adjusted Abnormal Returns (AR) for Firms Added and Deleted from Nordic Blue Chip Country Indices**

	Additions N = 177						Deletions N = 171					
	AD = 0:			CD = 0			AD = 0:			CD = 0		
Event Day	CAR	t(CAR)	% > 0	CAR	t(CAR)	% > 0	CAR	t(CAR)	% > 0	CAR	t(CAR)	% > 0
-5	-0.08 %	-0.43	45.40 %	0.27 %	1.64	51.70 %	-0.11 %	-0.56	44.64 %	0.51 %	2.07	51.19 %
-4	-0.37 %	-1.45	39.08 %	0.23 %	0.84	48.86 %	-0.06 %	-0.19	50.60 %	1.23 %	3.46	53.57 %
-3	-0.39 %	-1.14	45.98 %	0.51 %	1.58	55.11 %	-0.09 %	-0.28	48.21 %	1.06 %	2.58	55.95 %
-2	-0.03 %	-0.10	49.43 %	0.49 %	1.38	58.52 %	-0.02 %	-0.05	51.79 %	0.72 %	1.59	54.76 %
-1	-0.22 %	-0.57	49.43 %	0.36 %	0.96	55.68 %	-0.25 %	-0.56	46.43 %	0.06 %	0.14	53.57 %
0	-0.25 %	-0.59	50.57 %	0.27 %	0.68	56.25 %	-0.24 %	-0.47	48.21 %	-0.04 %	-0.07	56.55 %
1	-0.13 %	-0.30	51.72 %	0.12 %	0.26	53.41 %	-0.27 %	-0.50	50.60 %	-0.32 %	-0.60	48.81 %
2	-0.22 %	-0.45	51.15 %	0.45 %	0.98	51.70 %	-0.72 %	-1.22	50.60 %	-0.05 %	-0.09	52.38 %
3	-0.08 %	-0.15	51.72 %	0.46 %	0.94	56.25 %	-0.82 %	-1.24	51.19 %	0.13 %	0.22	53.57 %
4	-0.05 %	-0.08	53.45 %	0.14 %	0.26	56.25 %	-0.61 %	-0.88	52.98 %	-0.48 %	-0.74	54.17 %
5	-0.18 %	-0.30	49.43 %	0.06 %	0.11	56.25 %	-0.80 %	-1.09	51.19 %	-0.64 %	-0.89	51.19 %

Table presents the mean cumulative abnormal returns from days -5:5 relative to event dates (AD for announcements, CD for effective days). T-statistic is for one-sided test against zero. '% > 0' presents the percentage of positive cumulative abnormal returns. The sample contains additions and deletions from MSCI Nordic Countries Large and Mid Cap Indices and FTSE Nordic 30.

The results from region indices where traces of the premium were found point toward the latter option as there is no conceivable reason why the idiosyncratic risk would be smaller at blue chip index composition changes.

Table 16 **Long Window Statistics for Blue Chip Inclusions Daily Market-Adjusted Returns**

Specific Event Window	Event Days	N	MCAR	t	% > 0
Run-up	AD + 1, CD - 1	175	0.59 %	1.03	51.43 %
Post-AD Permanent	AD + 1, CD + 7	176	0.51 %	0.72	50.86 %
	AD + 1, CD + 10	176	0.49 %	0.63	52.00 %
Total Permanent	AD, CD + 7	176	0.48 %	0.68	52.57 %
	AD, CD + 10	176	0.46 %	0.61	53.14 %
Release	CD, CD + 7	176	-0.07 %	-0.16	52.00 %
Postrelease	CD + 8, CD + 10	171	-0.02 %	-0.07	49.41 %
		N	MAAR	t	% > 0
Run-up	AD + 1, CD - 1	175	0.04 %	0.86	49.71 %
Post-AD Permanent	AD + 1, CD + 7	176	0.02 %	0.96	50.86 %
	AD + 1, CD + 10	176	0.02 %	0.92	50.86 %
Total Permanent	AD, CD + 7	176	0.02 %	0.96	52.57 %
	AD, CD + 10	176	0.02 %	0.93	50.86 %

MCAR presents the mean of cumulative abnormal returns for given period. MAAR presents the average of abnormal returns divided by the number of days in the period. t is one-sided t-test where CARs are tested against zero.

Table 17 **Long Window Satistics for Blue Chip Exclusions Daily Market-Adjusted Returns**

Specific Event Window	Event Days	N	MCAR	t	% > 0
Run-up	AD + 1, CD - 1	168	-0.41 %	-0.61	52.38 %
Post-AD Permanent	AD + 1, CD + 5	168	-1.11 %	-1.23	48.21 %
	AD + 1, CD + 10	169	-0.40 %	-0.30	46.43 %
Total Permanent	AD, CD + 5	168	-1.10 %	-1.18	50.60 %
	AD, CD + 10	169	-0.40 %	-0.29	45.24 %
Release	CD, CD + 5	168	-0.70 %	-1.32	47.02 %
Postrelease	CD + 6, CD + 10	169	0.70 %	0.62	47.62 %
		N	MAAR	t	% > 0
Run-up	AD + 1, CD - 1	168	0.00 %	-0.07	51.19 %
Post-AD Permanent	AD + 1, CD + 5	168	-0.03 %	-0.88	52.38 %
	AD + 1, CD + 10	169	-0.03 %	-1.11	52.38 %
Total Permanent	AD, CD + 5	168	-0.02 %	-0.53	52.98 %
	AD, CD + 10	169	-0.02 %	-0.84	54.17 %

MCAR presents the mean of cumulative abnormal returns for given period. MAAR presents the average of abnormal returns divided by the number of days in the period. t is one-sided t-test where CARs are tested against zero.

Finally, table 18 present the -5:5 period MCARs and statistics for blue chip index inclusion and exclusion announements and effective days at batches of 3-4 years. Surprisingly the results show that the event period MCAR for exclusion announcements has risen from -3.24% at 2008-2010 to .58% at 2017-2020 while being mostly statistically significant as measured by t1 and t2. 2008-2013 have relatively significant negative MCARs for exclusion announcement while the corresponding metrics for 2014-2020 are closer to zero. As a result, t2-statistic for exclusion announcement is high. It would appear that MCARs for exclusion announcement event periods have in fact increased from negative to slightly positive, but as these statistics have proven to be unreliable when data is scarce and noisy and event study results for the whole period do not signal any abnormal price behaviour, such conclusion would be reckless.

Table 18	Blue Chip Index Premium Over Time							
	Inclusions							
	AD = 0, -5:5				CD = 0, -5:5			
Years	N	MCAR	t1	t2	N	MCAR	t1	t2
2008-2010	14	0.07 %	0.14	0.47	15	0.46 %	0.96	0.32
2011-2013	41	-1.44 %	-5.14	-4.09	41	-0.18 %	-0.76	-1.82
2014-2016	67	0.44 %	2.34	2.73	68	0.84 %	4.28	2.33
2017-2020	47	0.08 %	0.32	0.93	47	-0.19 %	-0.78	-1.82
	Exclusions							
	AD = 0, -5:5				CD = 0, -5:5			
Years	N	MCAR	t1	t2	N	MCAR	t1	t2
2008-2010	21	-3.24 %	-5.36	-4.61	20	0.77 %	0.99	0.72
2011-2013	46	-1.21 %	-3.79	-2.38	46	0.05 %	0.21	-0.51
2014-2016	55	0.29 %	1.31	2.41	55	0.18 %	0.79	-0.08
2017-2020	42	0.58 %	2.11	2.98	42	-0.17 %	-0.61	-1.18

MCAR presents the mean of cumulative abnormal returns for given period. t1 is one-sided t-test where CARs are tested against zero. In t2 CARs are tested against total period CARs.

5.5 Limitations

The methodology and data used in this thesis impose some limitations on interpretation of the results. Acknowledging them is critical for correct conclusions.

Release and post-release windows may have incorrect length. Lynch and Mendenhall (1997) use return of abnormal trading volume to normal as a proxy for when release period ends. As such analysis is not possible here, the lengths of release period are taken as they are in Lynch and Mendenhall (1997). Considering that this thesis uses over a decade newer data and from different market and different kind of indices, using the same release window lengths is close to an arbitrary guess, which however does seem work reasonably.

Method for calculating the small cap abnormal returns may be inadequate. In fact, for the entire sample of stock returns the average daily return is .138% while the average daily return for the index is only .018%. The method for calculating the abnormal returns exposes them for possible momentum which could be assumed to be larger for small cap stocks. This bias would materialize as inflated abnormal returns near inclusion and deflated abnormal returns near exclusion due to endogenous component remaining in the abnormal returns but should not affect short term relative changes in cumulative abnormal returns. Utilizing market model or even some more sophisticated economic or statistical model would be appropriate but creates other issues that are avoided here.

Because similar indices consist of generally similar stocks the potential for a stock to be included in multiple indices is especially high for small stock markets in the Nordics. Having multiple events for stocks makes the definition of ‘clean’ estimation period difficult. Thus, the implicit assumption in this study is that all events are ‘equal’ although that might be unreasonable. Stocks being included and having evens in multiple indices also raises a need or a possibility for controlling the events based on the number of indices the stocks are part of during them. Comparing the impact of events based on such control would present opportunities for more specific tests or information-based hypotheses but would also require larger sample and utilization of panel regression instead of classic event study.

The price data from investing.com might not be of very high quality at least from 2008-2011 period and causes issues that might distort some of the results of this study to some extent even when they are dealt with conservative imputation and filtering. It is unclear whether the issues could be avoided by using different data source or if their source are the Nordic exchanges or markets themselves.

6 CONCLUSION

This study focused on the effects of index composition changes on affected assets prices in Nordic stock markets in order to find whether this market exhibits index premium phenomenon. Using events study methodology with long window extension from Lynch and Mendenhall (1997) a total of eighteen Nordic indices from four different providers were examined in four different combinations to capture drivers and characteristics of the premium.

The results show traces of index premium in the total sample which behaves differently to that of different markets found in earlier literature. Where the theoretical framework and empirical findings typically show that the price effect of index composition changes behaves inversely for inclusions and exclusions but with larger magnitude with inclusions, the results here show that inclusions cause a subtle price impact when announced and no price impact when implemented, while the results for exclusions show significant decline in price around announcement and somewhat significant decline with traces of short term reversal around exclusion effective day. Long window results show that most of abnormal price action happens between the announcement and implementation.

Further examination shows similar behavior but with a larger magnitude of the premium for small cap stocks. Small cap stocks react to inclusion announcements with positive price increase that continues until the effective day and does not revert in near term. Exclusion of small cap stocks causes a significant price decline around announcement and a significant short-term price decline with short term reversal around the effective day. When blue chip stocks are included and excluded from indices covering the whole region their prices react to the announcements but show insignificant abnormal behavior round the effective days. Inclusions and exclusions from country specific blue-chip indices do not appear to cause abnormal price reactions.

The difference in magnitude of the price effects between inclusion and exclusion is puzzling but also the difference in their behavior contradicts the theoretical framework from academic literature. Positive reaction to inclusion announcements supports information-based theories and demand-based theories with the assumption that market anticipates the excess demand at effective day. However, the indices studied here are constructed transparently and therefore anticipating the content of the announcements is possible with high accuracy. Similarly, they do not disclose private information that would justify sharp reaction. The lack of abnormal price reactions around inclusion effective day shows that at that time the informational effects of index inclusion as well as the expectation of non-fundamental excess demand from indexers are correctly incorporated to prices as the efficient market hypothesis suggests. However, when stocks are removed from indices the behavior of the price effect changes drastically. The exclusion announcement causes a sharp price decline only in exclusions from region indices while small cap stocks decline significantly but smoothly around exclusion announcement. This kind of behavior is what information-based theories and demand-based theories assuming anticipation suggest but they do not provide explanation on why the price impact is larger for exclusions and why prices react to announcements as if they disclosed private information. Small cap stocks show a short and significant price drop followed by a sharp reversal of roughly 50-60% of the drop. This suggests a release of price pressure as price pressure hypothesis suggests but in this form the price pressure hypothesis is not supported by similar reversals in inclusions. Finally, the lack of abnormal price reactions for events in country specific blue-chip indices, which supposedly are tracked by less capital than region spanning ones hints at the possibility that the index premium in Nordic stock markets is driven more by excess demand than by informational effects.

The data and research methods used in this study cannot answer whether the effects found present arbitrage opportunities or if they are covered by idiosyncratic risk. As the magnitude of the price reactions are generally smaller than those found in previous literature, one should not expect exploitable opportunities based on this study. Similarly, while the possible index turnover cost cannot be calculated based on these data and results, the results here are not excessively alarming from passive investors' and index providers' point of view. Still, as the results indicate that at least for the small cap and regional indices studied here the stocks appear to enter the indices at inflated price and to exit them after significant declines, the extent of the index turnover cost for these indices could be looked into in future research or by practitioners. Significant index turnover cost might signal a need for index neutral passive investing products that rebalance their portfolios based on transparent index construction rules but at different times to those of the actual index.

Although the results here are not generalizable due to the uniqueness of Nordic market, the timeframe of the study, and to limitations in data and methodology, the extent of index premium and its peculiar behavior found in this study suggest that the research topic on index premium should be re-examined. Future studies could repeat earlier studies of the S&P 500 effect on current data to examine how the phenomenon has developed during the last decade. The possible results could shed light on the results here and either challenge or confirm the near hegemony of passive investments supremacy among retail investors and institutions.

To conclude, this thesis does in fact find traces of index premium in Nordic stock markets but fails to make further conclusions about it.

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